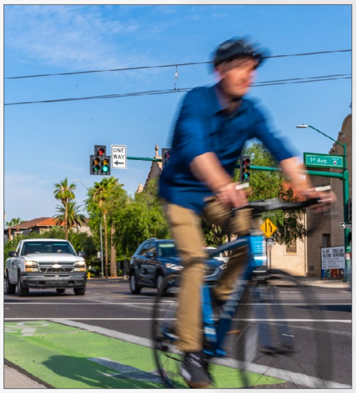
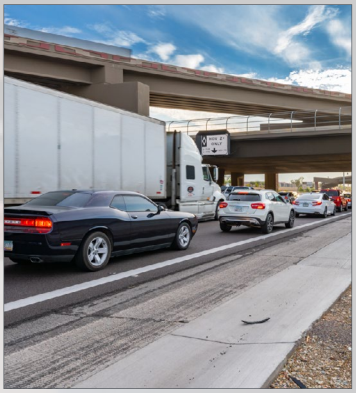
MARICOPA ASSOCIATION of GOVERNMENTS

2023 SYSTEM PERFORMANCE REPORT





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CONTENTS

LIST OF ACRONYMS ... 4

EXECUTIVE SUMMARY ... 5
- Safety and Congestion ... 5
- Accessibility and Equity ... 6
- Tempe Streetcar ... 6

INTRODUCTION ... 8

SYSTEM-LEVEL PERFORMANCE ... 9
- Federal Performance Targets ... 10
- PM1 – Safety Performance Targets ... 10
- PM2 – Bridge and Pavement Condition ... 14
- PM3 – System Reliability ... 15
- Transit Asset Management (TAM) ... 16
- Public Transportation Agency Safety Plans (PTASP) ... 18

REGIONAL MOBILITY & CONGESTION ... 19
- Recurring ... 21
- Freeway Bottlenecks ... 21
- Non-recurring ... 31

ACCESSIBILITY & EQUITY ... 32
- Interregional Comparison of Mobility and Equity ... 33
- Auto Comparison ... 34
- Congestion ... 35
- Transit Comparison ... 35
- Regional Frequent Service ... 36
- Frequent Service for Disadvantaged Communities ... 38
- Conclusion ... 41

TEMPE STREETCAR ... 42
- Introduction ... 43
- What is the Tempe Streetcar? ... 43
- Choosing the Course: The Logic Behind the Streetcar's Route ... 44
- Population and Employment Density ... 44
- Land Use and Development ... 45
- Navigating the Numbers: Initial Performance Metrics ... 47
- Tempe Streetcar Ridership ... 47
- Local Development ... 49
- Other Streetcar Systems ... 50
- Conclusion ... 54

PROJECT-LEVEL PRIORITIZATION & ANALYSIS ... 55

FUTURE OF THE PROGRAM ... 56

APPENDIX A – STATE & FEDERAL GUIDANCE ... 57

APPENDIX B – TRANSPORTATION PERFORMANCE DATA & SOURCES ... 58

APPENDIX C – ACCESSIBILITY & EQUITY, CULMINATION OF DATA ... 60

TABLES

Table 1 – System Reliability Measures 2-year & 4-year Targets 15
Table 2 – Air Quality and Emission 2-year & 4-year Targets........ 16
Table 3 – Transit Asset Management Targets 17
Table 4 – PTASP Safety Targets 18
Table 5 – Public Datasets Availability by Region........ 34
Table 6 – Transit Operators in Each Study Region 36

CHARTS

Chart 1 – Comparison of Serious Injury and Fatality Rates Since 2015........ 5
Chart 2 – Actual and Projected Annual Fatalities 2005-2024 11
Chart 3 – Actual and Projected Rate of Fatalities 2005-2024........ 11
Chart 4 - Actual and Projected Number of Serious Injuries 2005-2024........ 12
Chart 5 – Actual and Projected Rate of Serious Injuries 2005-2024........ 12
Chart 6 – Actual and Projected Number of Non-motorized Fatalities & Serious Injuries 2005-2024... 13
Chart 7 – 2-year Bridge and Pavement Condition Targets 14
Chart 8 – 4-year Bridge and Pavement Condition Targets 14
Chart 9 – VMT & Population, 2000-2023........ 20
Chart 10 – Annual Average Time Spent in Rush Hour per Commuter........ 35
Chart 11 – High Frequency Service as a Percentage of Total Service 37
Chart 12 – Median Headway Time for Transit Stops in Each of the Study Regions 38
Chart 13 – Percentage of Justice40 Population Served by High Frequency Transit........ 39
Chart 14 – Percent Share of Fixed Route Boardings in Tempe and the Entire Network 51
Chart 15 – Sun Link Ridership Between 2018-2022........ 52
Chart 16 – Passengers per Service Mile for Sun Link and Tempe Streetcar FY23........ 53
Chart 17 – Passengers per Service Mile for US Streetcar Systems and VM Rail........ 54

FIGURES

Figure 1 – Performance-Based Planning Concept........ 9
Figure 2 – Illustrations of the Locations for Each Agency of Study........ 33
Figure 3 – The SCAG Region's High Frequency Stops in Relation to Justice40........ 40
Figure 4 – A 1/4 Mile Buffer to Denote Justice40 Walking Distance to Stops 41
Figure 5 – Detailed Route Map for the Tempe Streetcar 44
Figure 6 – Population and Employment Density Along Tempe Streetcar........ 45
Figure 7 – Land Use Surrounding Tempe Streetcar........ 46
Figure 8 – Streetcar Route With Connections and Districts Labeled........ 47
Figure 9 – Streetcar Route With Connections, Districts, and More Boardings Labeled........ 48
Figure 10 – Route Map of Sun Link Streetcar in Tucson........ 51

LIST OF ACRONYMS

ADOT – Arizona Department of Transportation

ALISS – Accident Locator Surveillance System

CATT Lab – The Center for Advanced Transportation Technology Laboratory

CMP – Congestion Management Process

DRCOG – Denver Regional Council of Governments

FAST Act – Fixing America's Surface Transportation Act

FHWA – Federal Highway Administration

FMS – Freeway Monitoring System

FTA – Federal Transit Administration

GTFS – General Transit Feed Specification

H-GAC – Houston-Galveston Area Council

HSIP – Highway Safety Improvement Plan

IIJA – Infrastructure Investment and Jobs Act

ITS – Intelligent Transportation Systems

MAG – Maricopa Association of Governments

MAP-21 – Moving Ahead for Progress in the 21st Century

MPO – Metropolitan Planning Organization

NCTCOG – North Central Texas Council of Governments

NHS – National Highway System

PTASP – Public Transportation Agency Safety Plan

RITIS – Regional Integrated Transportation Information System

RTP – Regional Transportation Plan

SACOG – Sacramento Area Council of Governments

SCAG – Southern California Association of Governments

SOV – Single Occupancy Vehicle

TAM – Transit Asset Management

TCQSM – Transit Capacity and Quality of Service Manual

TIP – Transportation Improvement Program

TOD – Transit Oriented Development

TTI – Texas A&M Transportation Institute

TTR – Travel Time Reliability

TTTR – Truck Travel Time Reliability

VMT – Vehicle Miles Traveled

INTRODUCTION

EXECUTIVE SUMMARY

Transportation Performance Program

To make better, more data-driven, decisions MAG's Transportation Performance Program continues to fulfill two main functions:

1.) To meet federal requirements for performance measurement.

2.) To assist MAG in project evaluation and prioritization.

The first item requires collaboration with transportation partners and is guided by a variety of federal statutes outlined in Appendix A - State and Federal Guidance; the most notable being the Fixing America's Surface Transportation Act (FAST Act) and the Infrastructure Investment and Jobs Act (IIJA). The second requires coordination with MAG's member agencies and many divisions within MAG. Both elements require large datasets and a comprehensive understanding of their use and limitations. Background on the datasets used by the Transportation Performance Program can be found in Appendix B – Transportation Performance Data and Sources.

MAG's performance measurement program began in 2008 with the development of the Performance Measurement Framework and Congestion Management Update Study. Prior to that, performance activities were still conducted, in a less formalized fashion. A comprehensive history of performance measures at MAG can be found in Appendix C – History of Performance Measures at MAG.

The System Performance Report

The goal of this document is to provide a brief report highlighting the performance of the existing transportation system within the MAG region. Information is gathered from various transportation modes at multiple scales to provide a holistic view, allowing for deeper analysis of conditions within the system. From such analyses, MAG can pinpoint areas requiring deeper analysis and identify data gaps to help make thoughtful, informed planning decisions that positively impact community stakeholders. As the region continues to grow and new projects are undertaken, MAG will continue to employ a system of performance-based planning to keep equity and stakeholder perspectives at the core of MAG's work.

Safety and Congestion

By 2023, freeway traffic congestion reverted to its pre-COVID state, with volumes bouncing back robustly from spring 2021. While the PM peak remains the most congested time, the AM peak has seen a resurgence, and new congestion patterns have emerged during midday and weekends, reflecting evolving travel behaviors post-pandemic. Additionally, freeway bottlenecks have continuously shifted in location and characteristics due to changing demand, travel patterns, and construction activities, with the top bottlenecks now showing significant speed reductions and unreliable travel times.

Recent metrics underscore two contrasting trends. On a positive note, the region has witnessed a sustained decrease in the serious injury rate, suggesting that safety measures and infrastructure improvements might be having a positive impact. Conversely, there's been a notable uptick in fatality rates. While the exact causes of this rise are multifaceted and may require further investigation, it's evident that there's a pressing need for enhanced safety initiatives and strategies to address this upward trend in fatalities.

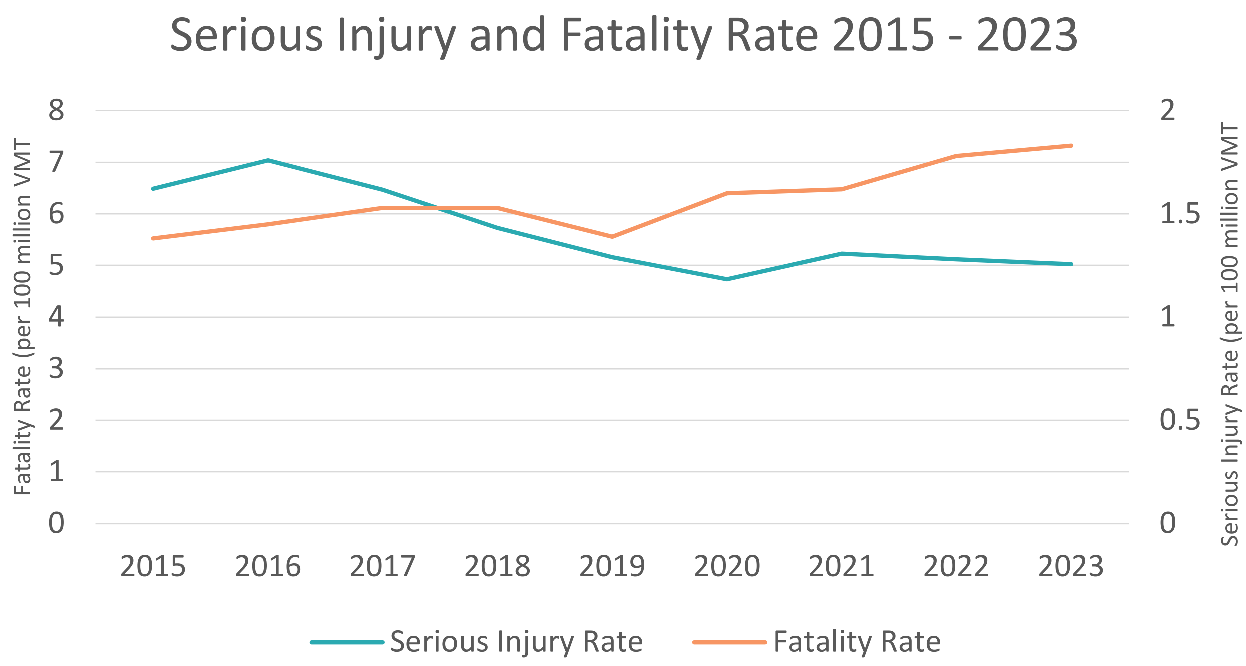


Chart 1 *— Comparison of serious injury and fatality rates since 2015.*

Accessibility and Equity

This follow-up chapter underscores the importance of equitable transportation accessibility. Building on the equity analysis within the MAG region, this chapter offers a broader perspective, encompassing MAG's peer regions. Notably, the SCAG region stands out for its exemplary connection of disadvantaged communities to high-frequency transit, highlighting the benefits of dense urban planning in promoting equitable transit access.

Tempe Streetcar

The Tempe Streetcar, a recent addition to the city's transit landscape, has significantly enhanced connectivity within Tempe, linking major hubs and alleviating congestion. With a design tailored for frequent stops and operation in mixed traffic, streetcar complements the existing transit infrastructure. Since its launch in May 2022, the streetcar has shown promising performance, influencing transit-oriented developments, and contributing to sustainable urban growth. Comparative insights with Tucson's Sun Link Streetcar further underscore its potential and the need for continuous monitoring and adaptation.

SYSTEM-LEVEL PERFORMANCE

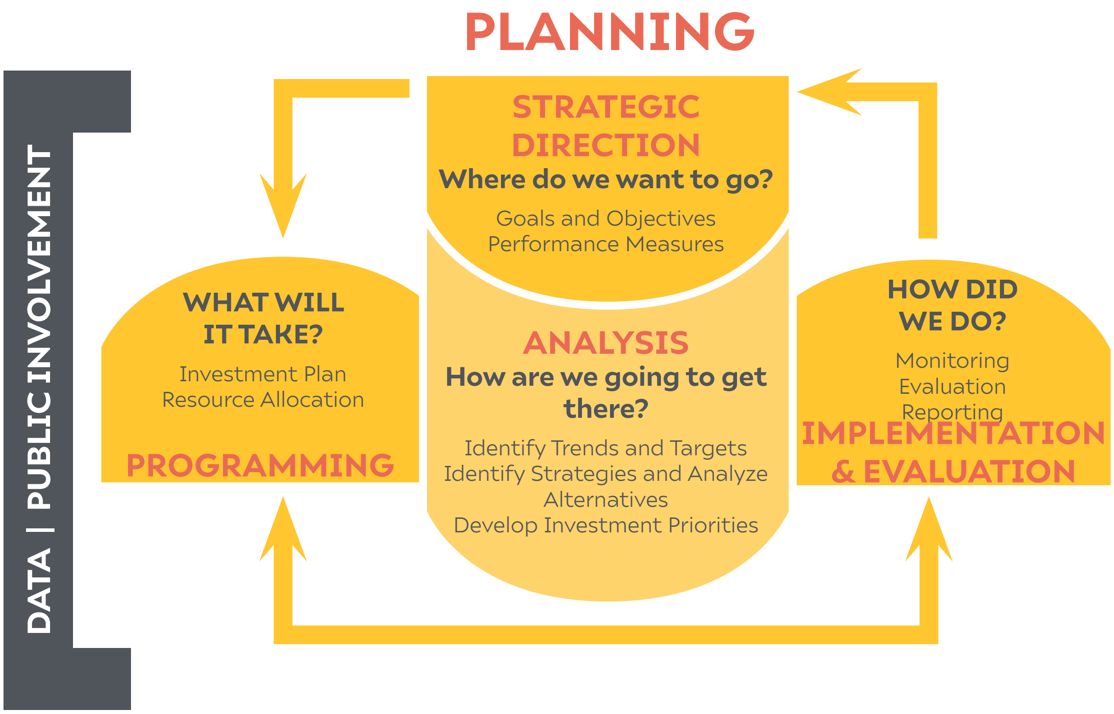


Figure 1 *— Performance-Based Planning Concept, Source: MAG*

SYSTEM-LEVEL PERFORMANCE

Federal Performance Targets

The current federal performance targets focus solely on metrics at the system level. Three groups of transportation performance measures and two transit-specific measures have been mandated. With each roadway-specific performance measure (PM), a metropolitan planning organization (MPO) can decide to support the targets set by the state or elect to develop their own targets. MAG has elected to calculate some targets, specific to the MAG planning area, and support other statewide targets as noted below. For the transit-specific measures, the MPO can elect to support the targets of its providers or develop regional targets in coordination with their providers.

PM1 – Safety Performance Targets

The Arizona Department of Transportation (ADOT) is required to submit established safety targets with their annual Highway Safety Improvement Program (HSIP) report to the Federal Highway Administration (FHWA). These safety targets are based on the Safety Performance Measures established by the FHWA Safety Performance Management final ruling and are based on five-year rolling averages.

The data below is compiled by ADOT. In 2021, MAG's policy committees elected to support the ADOT's statewide targets in perpetuity.

Safety targets established by ADOT are as follows:

S1: Number of Fatalities

The declining number of vehicle miles traveled (VMT) during The Great Recession from 2007 to 2009 resulted in a likewise decline in the number of fatalities statewide. As VMT steadily rose, the number of fatalities also increased, as shown in Chart 2.

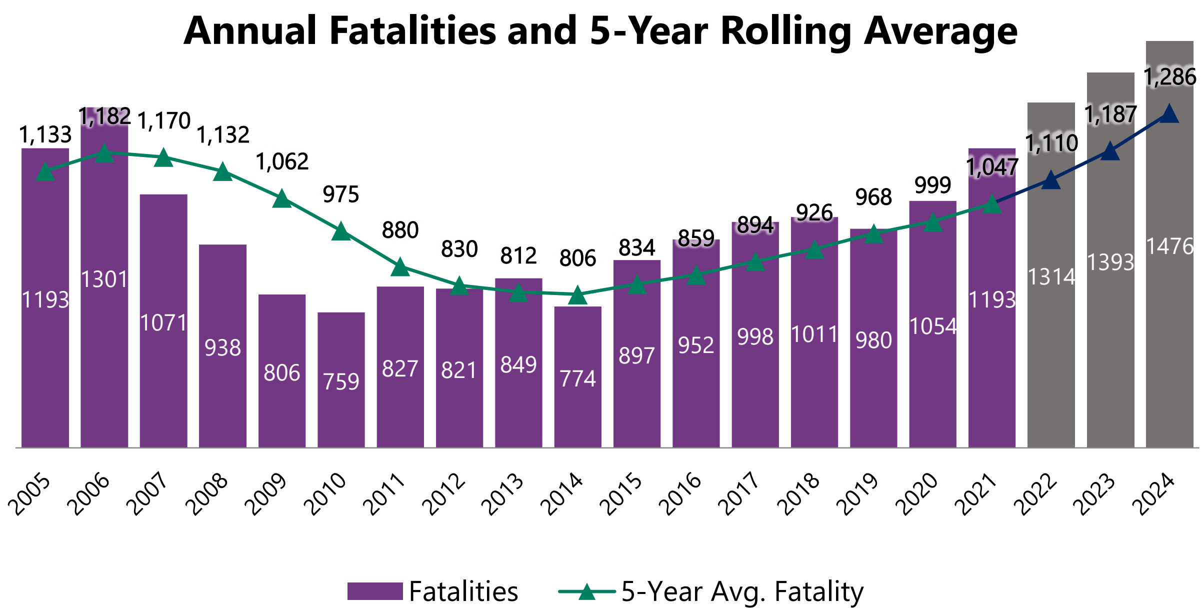


Chart 2 *— Actual and Projected Annual Fatalities 2005-2024, Source: ADOT*

S2: Fatalities per 100 Million VMT

Using a rate rather than an absolute number allows MAG to take into consideration the population growth our region has experienced.

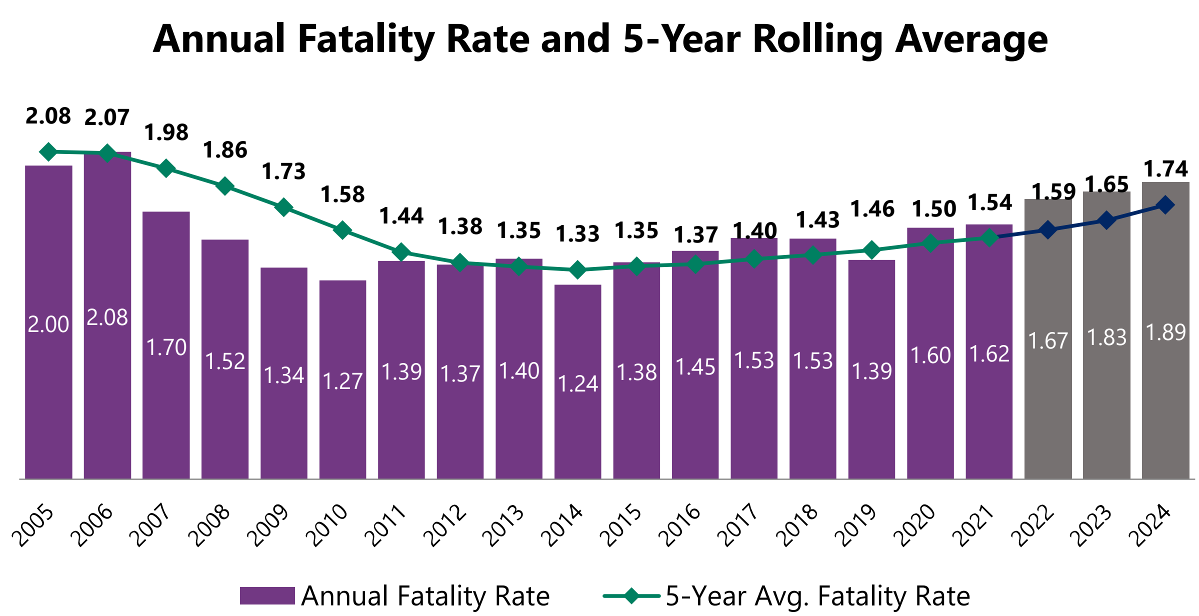


Chart 3 *— Actual and Projected Rate of Fatalities 2005-2024, Source: ADOT*

S3: Number of Serious Injuries

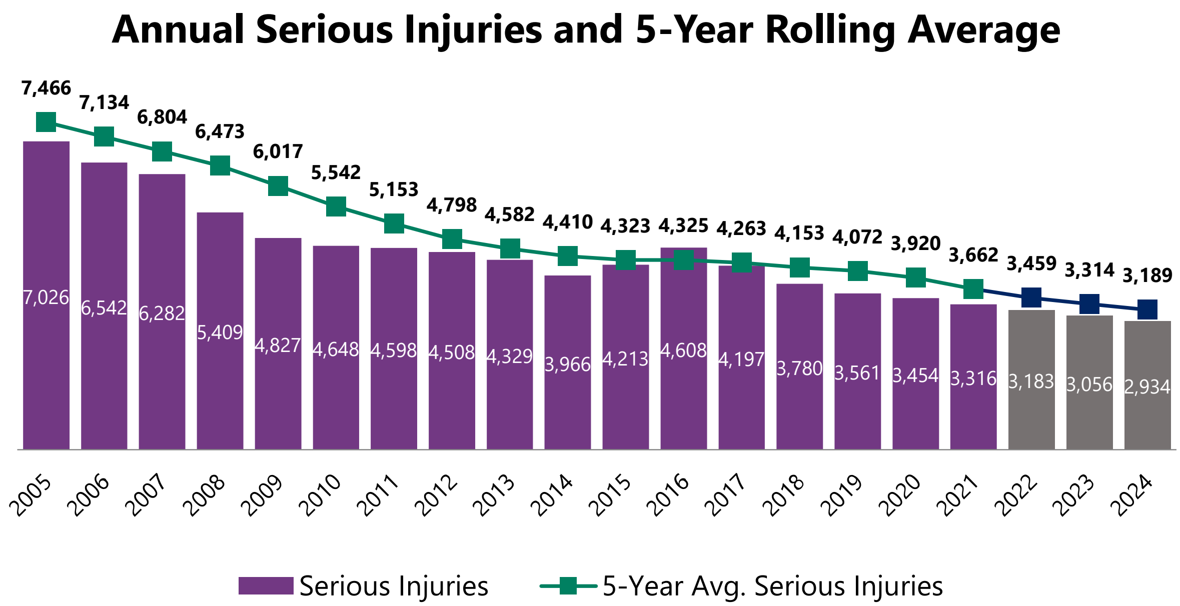


Chart 4 *— Actual and Projected Number of Serious Injuries 2005-2024, Source: ADOT*

Visit **FHWA** for more information about the definition of "serious injury."

S4: Serious Injuries per 100 Million VMT

As with fatalities, using rate rather than absolute numbers helps account for population growth.

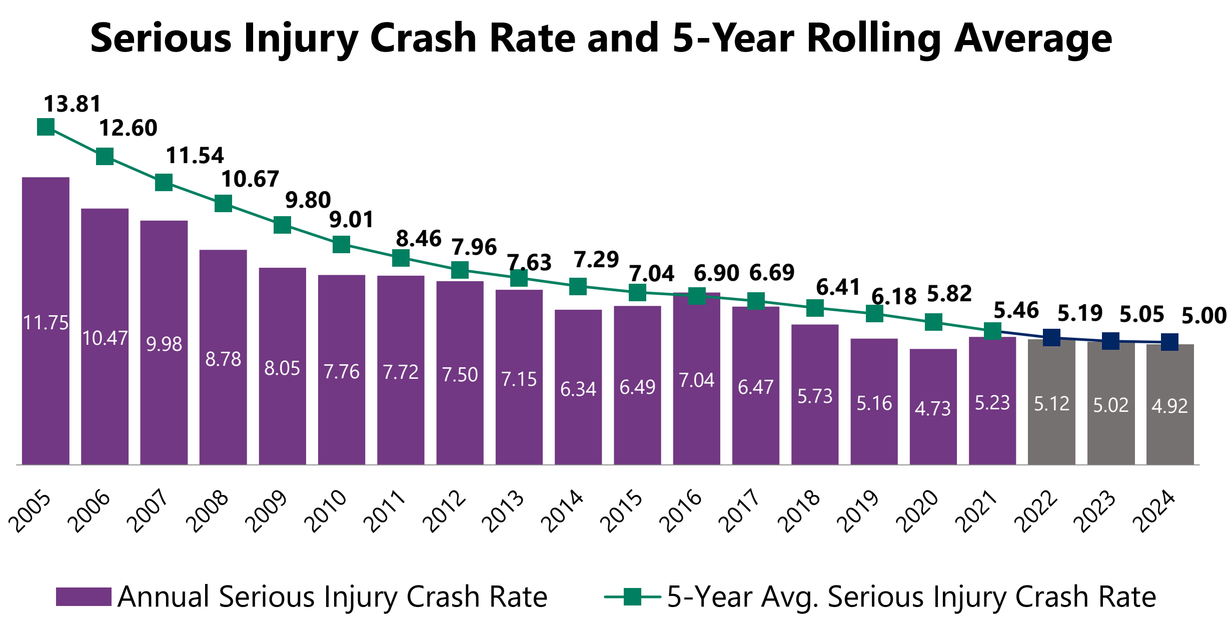


Chart 5 *— Actual and Projected Rate of Serious Injuries 2005-2024, Source: ADOT*

[1] https://www.ghsa.org/sites/default/files/2020-02/GHSA-Pedestrian-Spotlight-FINAL-rev2.pdf#page=9 Accessed 6/6/2022.

S5: Number of Non-motorized Fatalities and Non-motorized Serious Injuries

Reducing non-motorized fatalities is a high priority for both the state and the MAG region. A recent report from the Governor's Highway Safety Association placed Arizona as the seventh-worst state in the nation for pedestrian deaths per capita[1].

Annual Non-motorized Fatalities and Serious Injuries and 5-Year Rolling Average

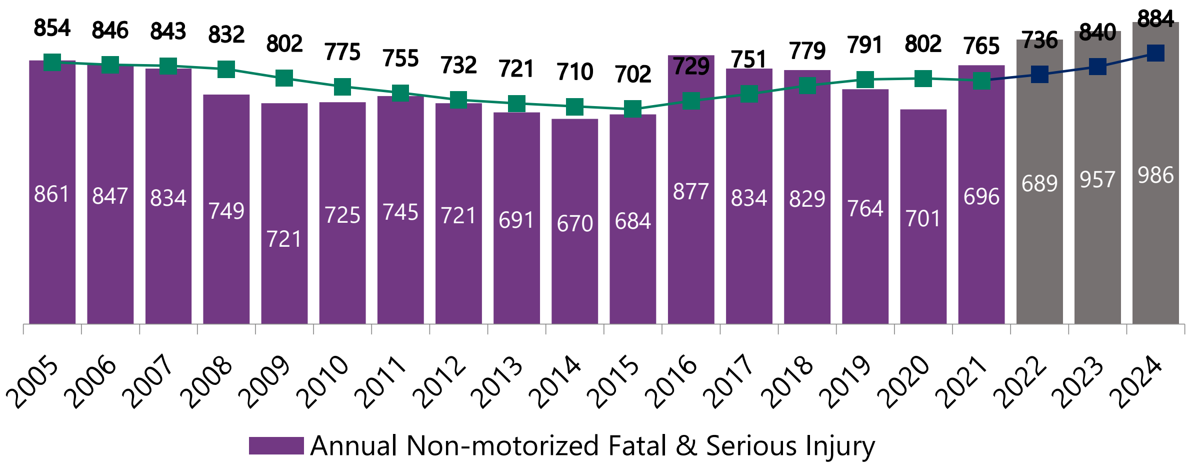


***Chart 6** — Actual and Projected Number of Non-motorized Fatalities and Serious Injuries 2005-2024 and 5-year rolling average, Source: ADOT*

More information on safety efforts can be found on **MAG's Safety Programs webpage.**

Target Setting

The safety targets set by ADOT are data-driven and realistic. They are intended to keep the state focused on improving safety while still striving for the goals of the MPOs' regional strategic transportation safety plans and Arizona's State Strategic Traffic Safety Plan of reducing the number of traffic fatalities and serious injury crashes.

MAG is committed to doing the following:

- Continue to administer the MAG Roadway Safety Program to fund low-cost safety improvements as a supplement to the state's HSIP. This program provides local agencies the flexibility to implement near-term safety improvements in an expedited manner.
- Work with the state and safety stakeholders to address areas of concern for fatalities or serious injuries within the metropolitan planning area.
- Coordinate with the state and include the safety performance measures and HSIP targets for all public roads in the metropolitan area in the Regional Transportation Plan (RTP).
- Integrate into the metropolitan transportation planning process the safety goals, objectives, performance measures, and targets described in state safety transportation plans and processes such as applicable portions of the HSIP, including the Arizona Strategic Traffic Safety Plan.
- Include a description in the Transportation Improvement Program (TIP) of the anticipated effect its implementation will work toward achieving HSIP targets in the RTP, linking investment priorities to safety targets.

PM2 – Bridge and Pavement Condition

The second set of performance measures requires the establishment of 4-year targets for pavement and bridge condition on the Interstate and non-Interstate National Highway System (NHS). On August 30, 2022, the ADOT formally notified MAG that it had established targets for the second federal performance period covering 2022-2025. MAG supports ADOT's 2022-2025 performance targets, along with all of their PM2 targets, and identifies MPO specific targets.:

- Percent of Interstate Pavements in Good Condition: 44 percent
- Percent of non-Interstate NHS Pavements in Good Condition: 28 percent

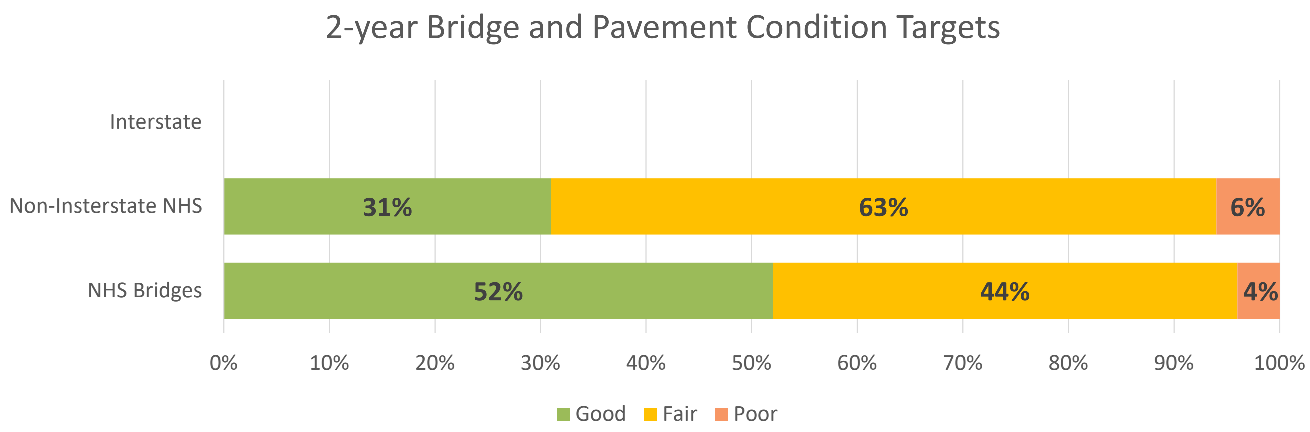


Chart 7 *— 2-year Bridge and Pavement Condition Targets, Source: ADOT*

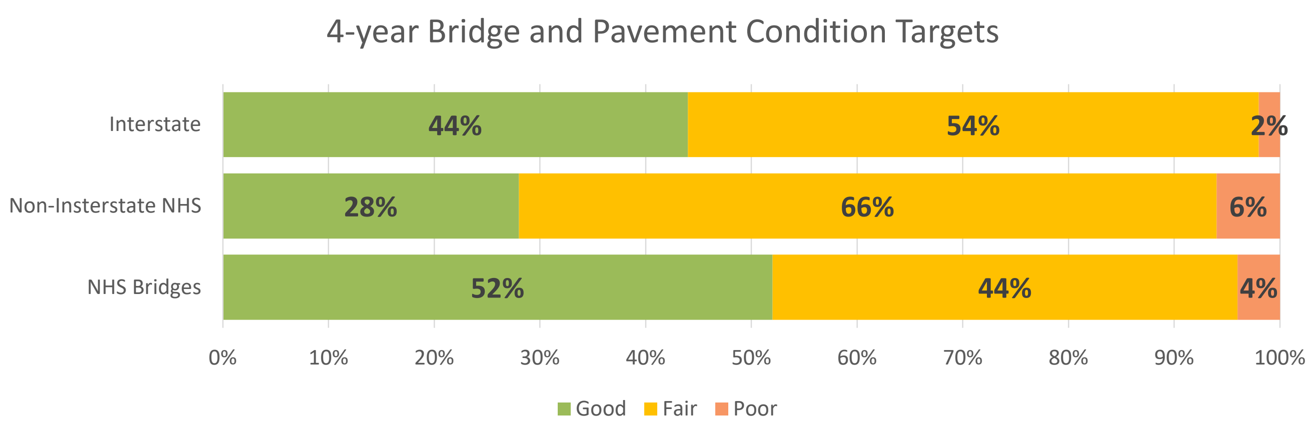


Chart 8 *— 4-year Bridge and Pavement Condition Targets, Source: ADOT*

To provide some context, MAG's NHS roadways represent 16% of the total non-Interstate NHS roadway lane miles in the state and MAG's bridge deck area is 3.1% of the total state NHS bridge deck area.

PM3 – System Reliability

In collaboration with ADOT, MAG's transportation and environmental divisions developed methodology for and calculated several reliability and emission measures as part of PM3.

	ADOT		MAG	
MEASURE	2-YEAR TARGET	4-YEAR TARGET	2-YEAR TARGET	4-YEAR TARGET
Travel Time Reliability - Interstate System	81.00%	71.00%	64.28%	62.50%
Travel Time Reliability - Non-Interstate NHS	84.00%	77.00%	69.95%	67.00%
Truck Travel Time Reliability Index	1.37	1.48	1.75	1.91
Peak Hour Excessive Delay Per Capita (Phoenix-Mesa UZA)	7.5 Hours	8.0 Hours	7.5 Hours	8.0 Hours
Peak Hour Excessive Delay Per Capita (Avondale-Goodyear UZA)	4.5 Hours	5.4 Hours	4.5 Hours	5.4 hours
Percentage Non-SOV Travel (Phoenix-Mesa UZA)	23.50%	24.00%	23.50%	24.00%
Percentage Non-SOV Travel (Avondale-Goodyear UZA)	21.00%	21.50%	21.00%	21.50%

***Table 1** — System Reliability Measures 2-year and 4-year Targets, Source: MAG, ADOT*

The targets above speak to the reliability of our transportation system. Each measure speaks to a different facet of transportation:

- **Travel Time Reliability (TTR)** – This target represents the percentage of miles that are reliable. Reliability measures the variability of observed travel times on a roadway segment. The less variability, the more reliable a roadway segment is. Incidents, weather events, and congestion reliability. It should be noted that a roadway can also be "reliably congested." The TTR measure indicates the degree to which you can expect the same condition each day, not necessarily an uncongested condition.

- **Truck Travel Time Reliability (TTTR)** – Produced from the National Performance Management Research Data Set, this target addresses the reliability of travel time for trucks on the Interstate system.

- **Peak Hour Excessive Delay Per Capita** – This target is measured by the annual hours of excessive delay per capita on the NHS. The threshold for excessive delay is based upon the travel time at 20 miles per hour or 60% of the posted speed limit, whichever is greater.

- **Percentage of Non-Single Occupancy Vehicle (SOV) Travel** – This represents vehicles that have more than one occupant, or are operation at a higher capacity than average. This percentage is taken from the American Community Survey commuting data.

Visit **FHWA** for more information about the calculations above.

Unlike for PM1 and PM2, MAG has opted to set specific PM3 targets for the region. Analysis showed the statewide numbers for the three reliability measures were not representative of the conditions within the MAG region. As a result, MAG-specific targets were calculated.

For the On-Road Mobile Source Emissions Reduction Measure, PM3 also requires the establishment of emissions reduction targets for Congestion Mitigation and Air Quality Improvement Program funded projects. These targets were developed by MAG's Environmental Division and codified by MAG Regional Council. In Table 2 below, the targets for reducing Volatile Organic Compounds (VOC), Carbon Monoxide (CO), Nitrogen Oxide (NOx), Particulate Matter that is 10 microns or less (PM-10), and Particulate Matter that is 2.5 microns or less (PM-2.5) are displayed.

EMISSION REDUCTION TARGETS (KG/DAY)	VOC	CO	NOX	PM-10	PM-2.5
2-Year Target (FY2018-2019)	222.95	5,027.92	393.89	965.37	0.00
4-Year Target (FY2018-2021)	343.67	8,120.90	572.14	1,817.64	3.47

***Table 2** — Air Quality and Emission 2-year and 4-year Targets, Source: MAG*

For more information on MAG's emission reduction efforts, please visit **MAG's Environmental Division**.

The MAG Regional Council formally accepted these targets as outlined above at their February 22, 2023, meeting.

Transit Asset Management

Since 2018, transit providers who receive Chapter 53 federal funds are required to create a transit asset management plan. The goal of a Transit Asset Management (TAM) plan is to help agencies manage their assets operationally and financially.

There are two tiers of providers with different reporting requirements. Tier I providers represent a transit provider with more than 100 vehicles in their fleet. For 2023, four agencies in the MAG region met that threshold: Valley Metro RPTA, Valley Metro Rail, the City of Phoenix, and the City of Tempe. Other agencies providing transit, but below that threshold, are known as Tier II providers. Tier II providers may be covered under the state TAM plan.

To address the requirement that MPOs must develop regional TAM targets, MAG has established a working group comprised of Tier I agencies to coordinate TAM on a biannual basis. The TAM targets are taken through MAG's committee process for approval each year. The latest TAM targets, approved by MAG Regional Council on March 15th 2023, are in Table 3 below.

ROLLING STOCK		FY 22 REGIONAL TARGET (%)	FY 22 REGIONAL TARGET (#)
Category	Useful life benchmark	Percentage of revenue vehicles that have met their useful life benchmark	
Light Rail Vehicle	31 years	0%	0 of 57
Streetcar Rail	31 years	0%	0 of 6
Buses 40′ Heavy Bus	14 years	0%	0 of 399
Buses 60′	14 years	0%	0 of 101
Bus	12 years	3%	10 of 309
Cutaway Buses	7 years	3%	8 of 173
Dedicated Paratransit Vehicles	8 years	0%	0 of 54-
Vanpool	8 years	6%	17 of 285-
EQUIPMENT			
Category	Useful life benchmark	Percentage of service vehicles that have met their useful life benchmark	
Equipment and Non-Revenue Vehicles	8 years (auto)	33%	4 of 12
	10 years (auto)	18%	2 of 11
	14 years (auto)	8%	12 of 159
FACILITIES			
Category	Criteria	Percentage of facilities below 3 on condition scale	
Administration/ Maintenance Facility	Condition based	0%	0 of 7
Transit Center/ Passenger Parking Facility	TERM[1] scale (1-5)	4%	1 of 25
Passenger Stations		5%	2 of 43
INFRASTRUCTURE			
Category	Criteria	Percentage of guideway under performance restriction	
Guideway Performance	Performance restriction[2]	1%	-

[1]Transit Economic Rate Model

[2]The light rail vehicle must slow to less than normal traveling speed

Table 3 *— Transit Asset Management Targets, Source: MAG*

For more information about TAM plans visit the **United States Department of Transportation.**

Public Transportation Agency Safety Plans (PTASP)

The Federal Transit Administration (FTA) requires that all operators of public transportation systems receiving federal financial assistance from the Urbanized Area Formula Program complete a PTASP that includes safety performance targets set by the transit provider. In the MAG region, those providers are the City of Phoenix and Valley Metro RPTA and Valley Metro Rail. In accordance with this requirement, these providers have set targets based on previous benchmarks. The four target categories that are included in the PTASP are as follows:

- **Safety Event** - A collision, derailment, fire, hazardous material spill, act of nature (Act of God), evacuation or other safety occurrence not otherwise classified (OSONOC) occurring on transit right-of-way, in a transit revenue facility, in a transit maintenance facility, or involving a transit revenue vehicle that meets the established NTD reportable thresholds.

- **Injury** – Any damage or harm to persons as a result of an event that requires immediate medical attention away from the scene.

- **Fatality** – A death or suicide confirmed within 30 days of a reported event. Does not include deaths in or on transit property that are a result of illness or other natural causes.

- **System Reliability** – The rate of vehicle failures in service, defined as mean distance between major mechanical failures.

Targets are first derived from each transit operator, then each target category is combined to establish the regional PTASP targets. Below is Table 4 indicating these targets:

	FY23 Regional Target (per 100k miles)	FY23 Regional Target (#)
Motor Bus (MB)		
Fatalities	0.1	2.67
Injuries	0.20	54
Safety Events	3.35	487
System Reliability	-	14,375*
Demand Response (DR)		
Fatalities	-	-
Injuries	0.02	0.67
Safety Events	0.06	1.67
System Reliability	-	20,193*
Rail (LR - SR)		
Fatalities	0.44	1
Injuries	0.55	13
Safety Events	1.35	41
System Reliability	-	15,000*

**Average miles between failures*

Table 4 *— PTASP Safety Targets, Source: MAG*

For more information about PTASP visit the **United States Department of Transportation.**

REGIONAL MOBILITY & CONGESTION

REGIONAL MOBILITY & CONGESTION

Despite being the 11th largest metropolitan statistical area in the U.S. , Tom Tom Travel Index data lists Phoenix as the 53rd most congested city in the United States for 2022,. That puts the level of congestion in Phoenix metro region ahead of other cities like Tucson, Houston, and Las Vegas. The MAG region still experiences congestion, particularly during peak periods. Congestion affects the movement of people and goods and exacerbates air quality and climate issues due to increased fuel consumption.

As Chart 8 shows, Arizona's population has been steadily growing alongside VMT. This trend is expected to continue and will place further stress on transportation systems. This will lead to increased congestion should mitigation efforts be unable to keep pace.

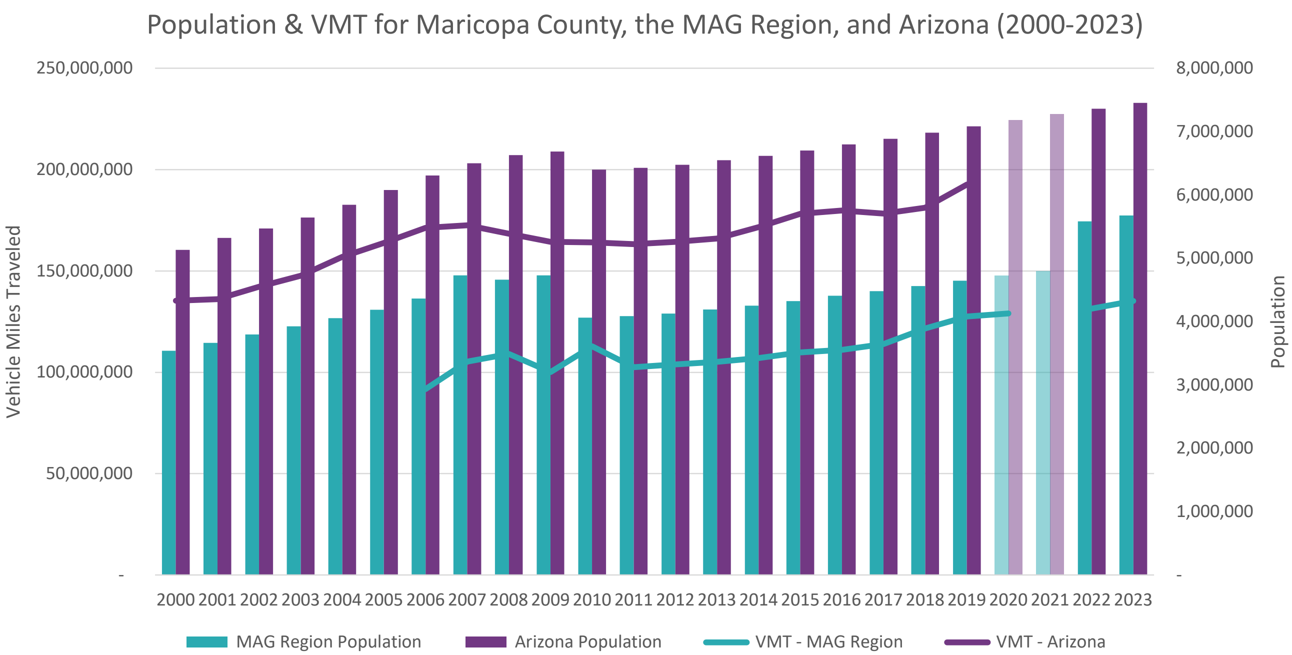


Chart 9 *— VMT and Population, 2000-2023, Source: ADOT, MAG*

MAG uses several data sources across a variety of facilities to examine congestion in the region. For the purposes of performance measurement, congestion is defined as a ratio of the measured speed divided by the speed limit for each stretch of roadway in the network. The data is further broken down by time periods.

[2]**https://www.census.gov/library/visualizations/interactive/2020-population-and-housing-state-data.html.** Accessed 6/6/2022.

[3]**https://www.tomtom.com/en_gb/traffic-index/ranking/?country=US.** Accessed 4/5/2022.

There are two types of congestion:

Recurring

Daily congestion—not related to construction, crashes, or special events—is known as recurring congestion. Recurring congestion is found in areas where demand temporarily exceeds capacity and viable travel alternatives, such as high-capacity transit, are unavailable. Texas A&M Transportation Institute publishes an annual mobility report that attempts to quantify the costs of congestion. Since 2010, congestion in the region has historically cost the average auto commuter over $1,000 per year between excess fuel consumption and the loss of personal time—this translates to an estimated region-wide cost of over $33 billion over the last decade The costs go beyond wasted time and money, congestion can be attributed to over 673,000 tons of excess CO_2 emissions for all vehicles.

Freeway Bottlenecks

Freeway congestion is distributed across the region and is primarily observed during the AM (6 AM – 9 AM) and PM (2 PM – 6 PM) peak periods. Congestion is also observed during the midday (9 AM – 2 PM) and nighttime (6 PM – 6 AM) periods, though less frequently. Freeway bottlenecks are a series of congested and consecutive freeway segments which repeatedly cause significant delays to travelers. Freeway bottlenecks are typically recurring and observed at similar locations in a particular direction, day in and day out. Some bottlenecks only occur during a specific peak period, and some occur during multiple peak periods. The comprehensive temporal-spatial coverage of speed data allows us to study and measure freeway bottlenecks on a daily level, throughout an extended period (January to April in 2023).

- **Freeway traffic congestion has returned to pre-COVID conditions.** In the spring of 2021, freeway traffic volumes rebounded to pre-COVID levels and have steadily grown ever since. Two years later in the spring of 2023, freeway congestion in the area has now reverted to its pre-COVID state. By the end of 2021, congestion was at 70 percent of its pre-COVID levels, which further increased to 85 percent in the spring of 2022.• Travel patterns continued to evolve. Freeway congestion and bottlenecks characteristics look different from previous years because travel patterns have changed due to the pandemic. For example, a sizable portion of commute trips between home and work vanished in 2020 when the workforce largely shifted to full- or part-time telecommuting. This contributed greatly to the reduced traffic congestion during the peak periods.

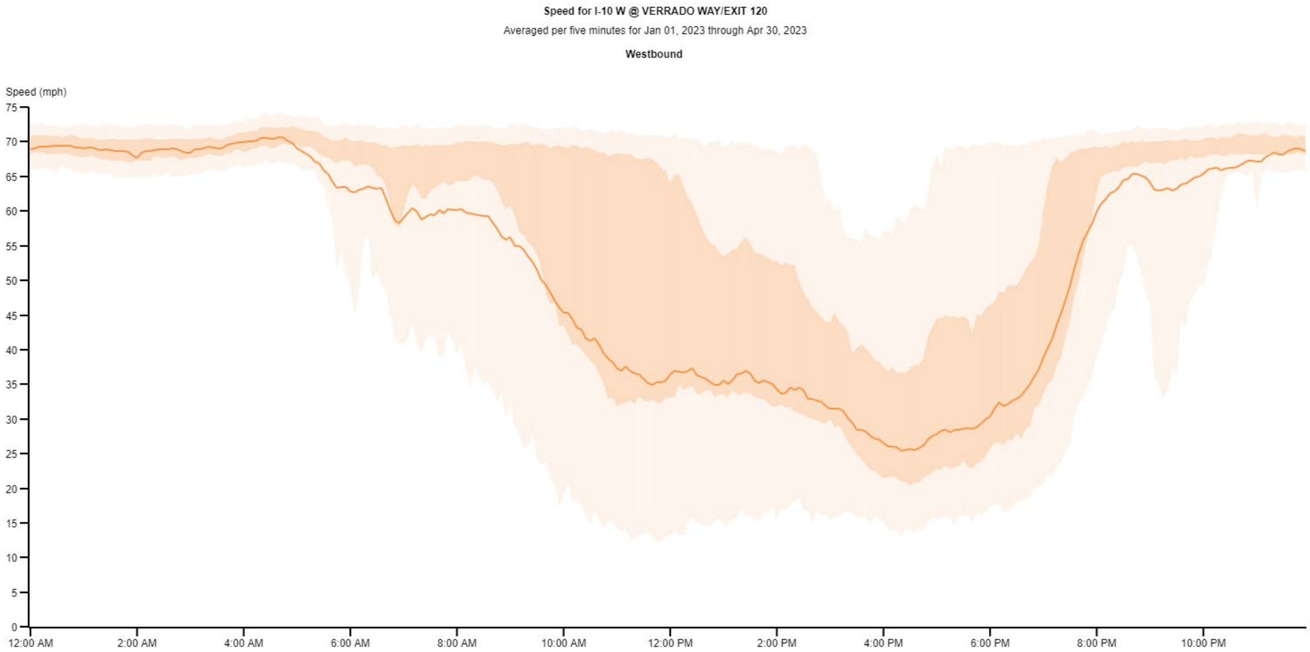
- **Freeway congestion and bottlenecks characteristics look different in 2023.** Throughout the day, the PM peak remains the busiest period in terms of both traffic volume and congestion on the freeway system. As travel patterns continue to evolve, some new findings have emerged. Firstly, congestion during the AM peak has fully returned, indicating a revival of morning rush hour traffic. Secondly, there have been observations of congestion in certain freeway areas during noon time, suggesting a shift in midday travel patterns. Finally, congestion has been noticed during weekends, and occasionally, Saturday's congestion level exceeds that of specific weekdays in the regional freeway system, signaling changes in traditional commuting trends.

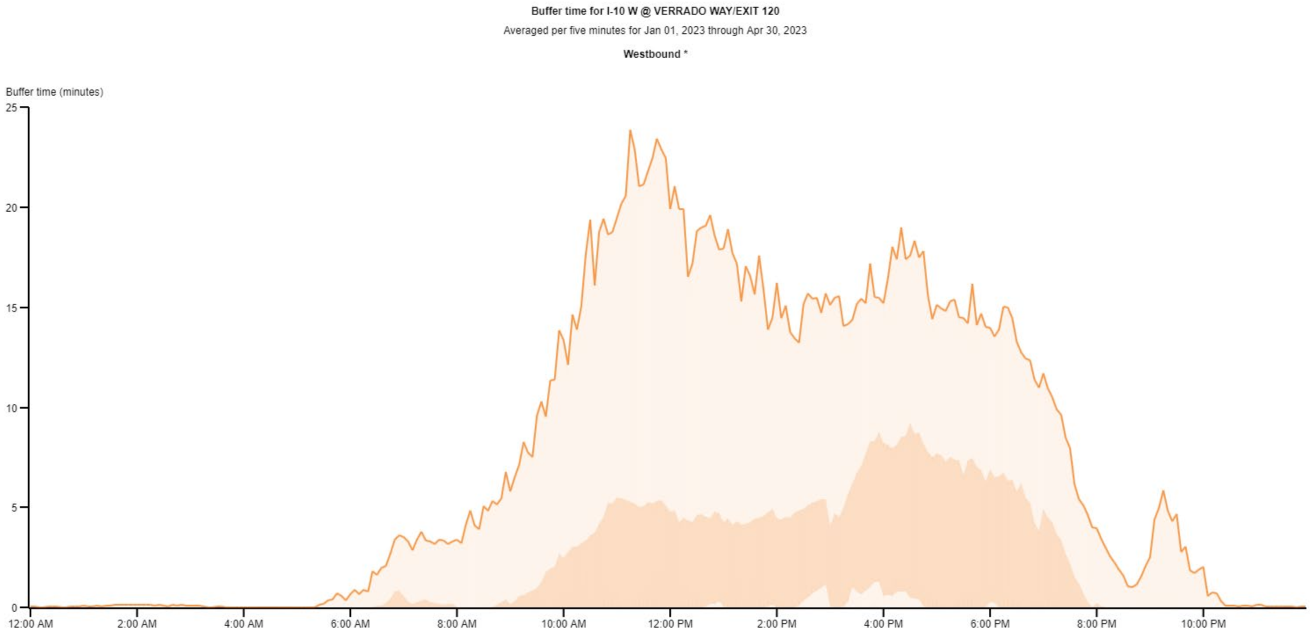
- **Freeway bottleneck locations and characteristics continued to alter.** The positions and characteristics of freeway bottlenecks have undergone continuous transformations due to fluctuations in freeway demand, changes in travel patterns, and ongoing construction activities. A comparison with the previous year reveals a shift in the list and ranking of bottlenecks within the regional freeway system. The top bottlenecks highlighted in this section exhibit a considerable decrease in speed, unreliable travel times, prolonged congestion durations, and frequent occurrences. However, it's important to note that the underlying causes behind each bottleneck vary.

These bottlenecks present different congestion delay characteristics, as shown in the following charts.

The first chart displays the bottleneck's speed profile of average speed, 5% speed, 25% speed, 75% speed, and 95% speed. The second chart displays the bottleneck's buffer time profile of 5% speed, 25% speed, 75% speed, and 95% speed. Buffer time is the additional time added to the journey due to congestion for the commuters to complete the trip. The last two charts indicate bottleneck's location and occurrence time (from inner ring to outer ring as from January 1, 2023, to April 30, 2023).

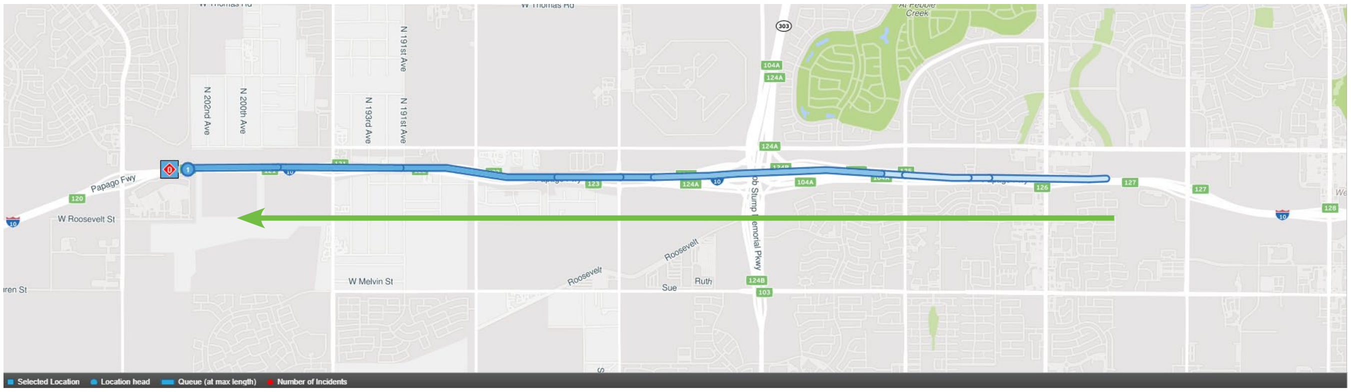
Bottleneck #1 — I-10 Westbound, from approximately Bullard Ave to Verrado Way (Exit 120)



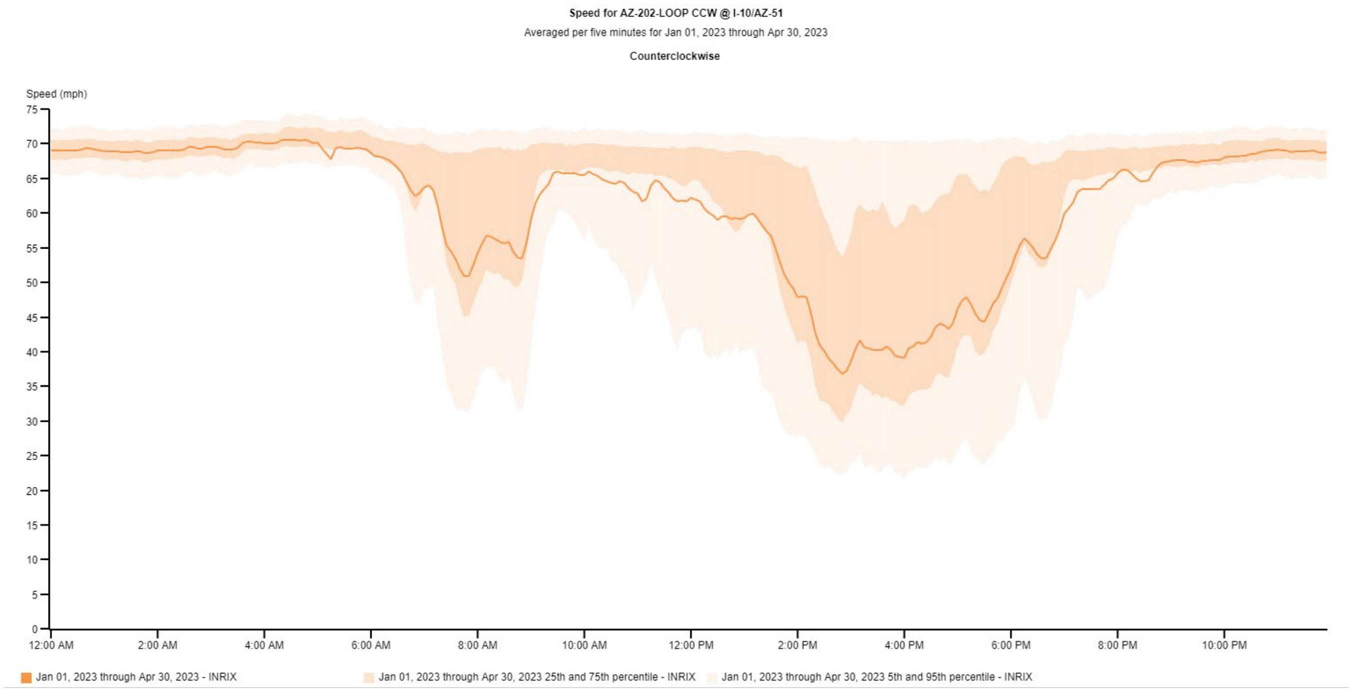


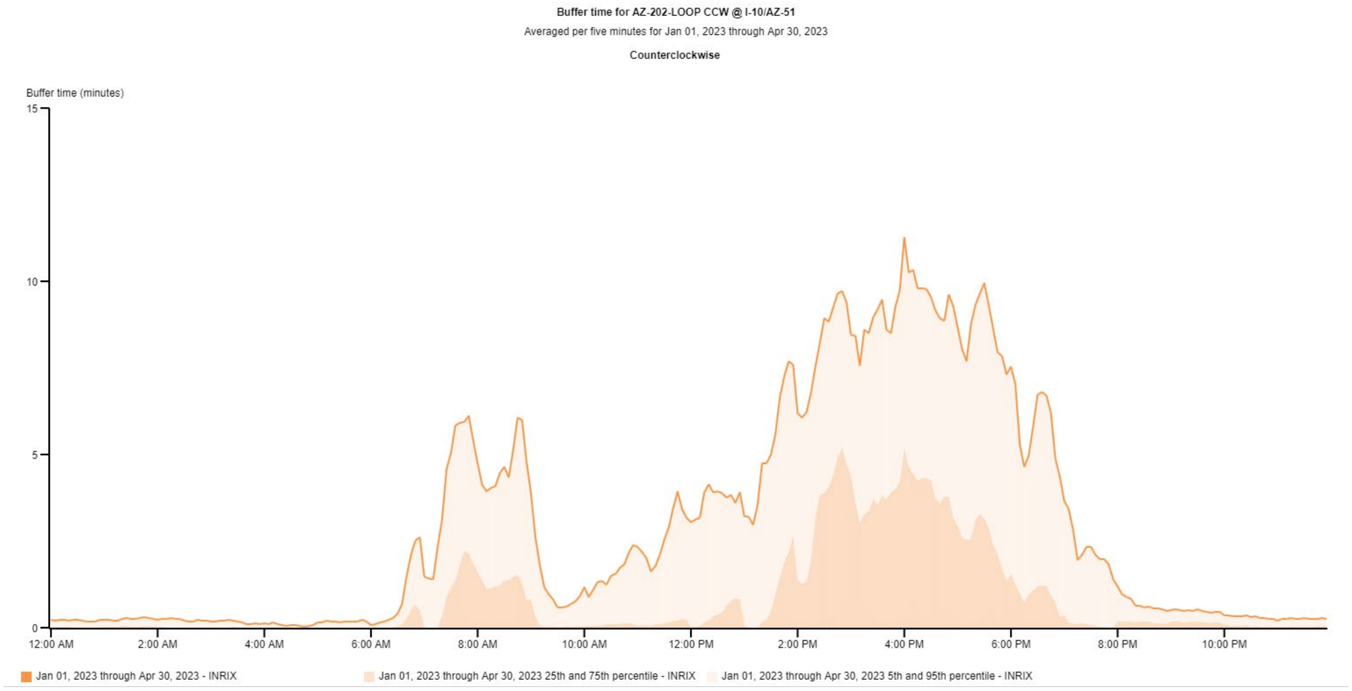
* These missing segments are a result of 0 MPH measurements. Buffer time cannot be calculated when the 95th percentile speed for a road segment is 0 mph or not available.

The length of the bottleneck from the head is 8 miles. Congestion begins from morning peak hours and becomes worse in the afternoon and evening. Maximum congestion is observed during the evening peak hour where speed drops from 65 mph to 30 mph. Interestingly higher buffer times are observed during the morning peak hour where commuters spend up to 25 minutes of additional time. Freeway construction may contribute to the magnitude of congestion on this bottleneck. Figure below shows the location of the bottleneck.

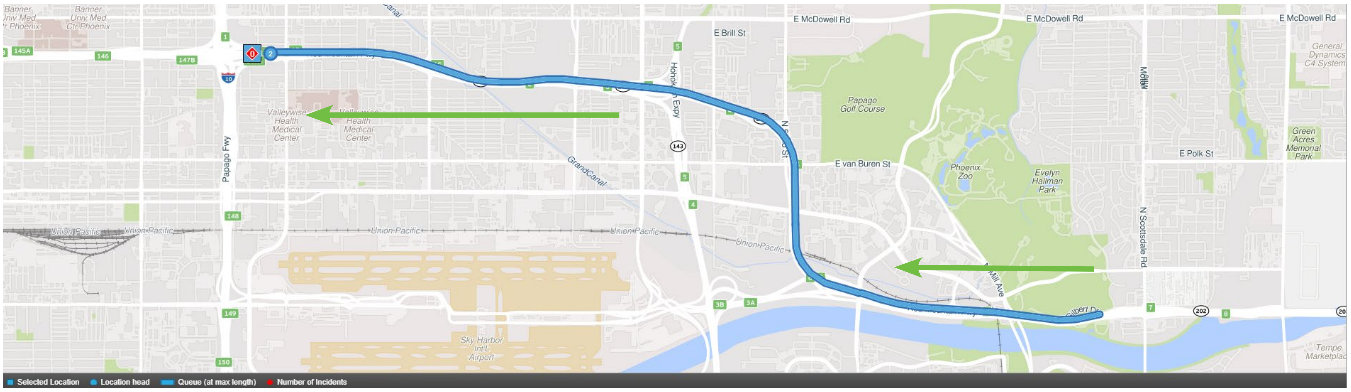


Bottleneck #2 — Loop 202 Red Mountain Westbound, from approximately Scottsdale Road (Exit 7) to SR-51/I-10

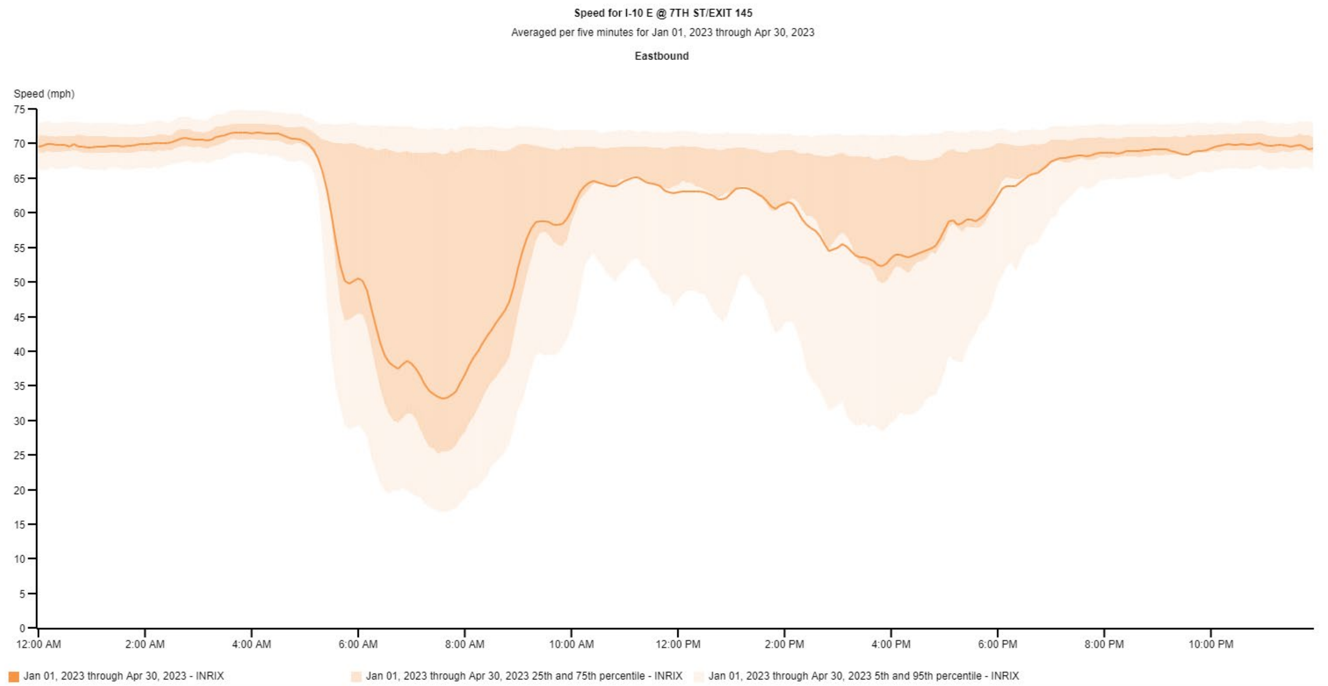


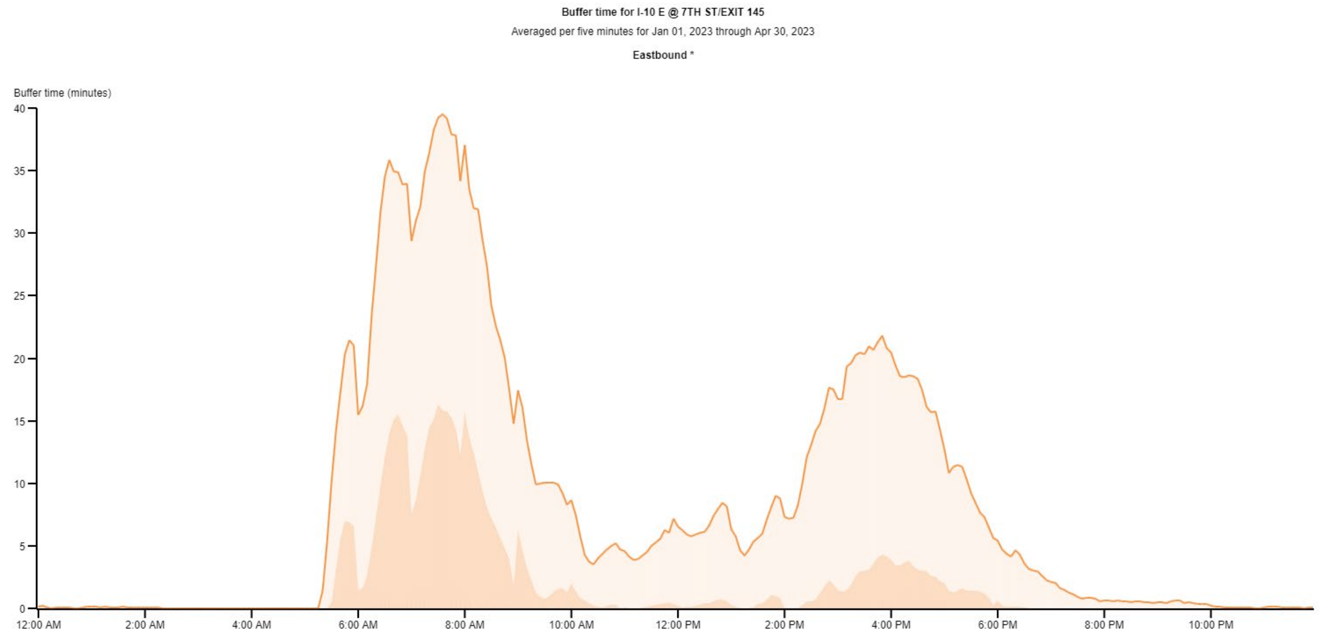


The length of the bottleneck from the head is 6 miles. Congestion reaches the highest during the evening peak period between 2 PM and 6 PM. This bottleneck presents two congestion periods in both AM and PM, and sometimes congestion is observed around noon time during weekdays. A 5-minute buffer time is experienced by the commuters for a shorter period during AM peak period, and a 10-minute buffer time is experienced by the commuters for a longer period during PM peak period. Figure below summarizes the location of the bottleneck.



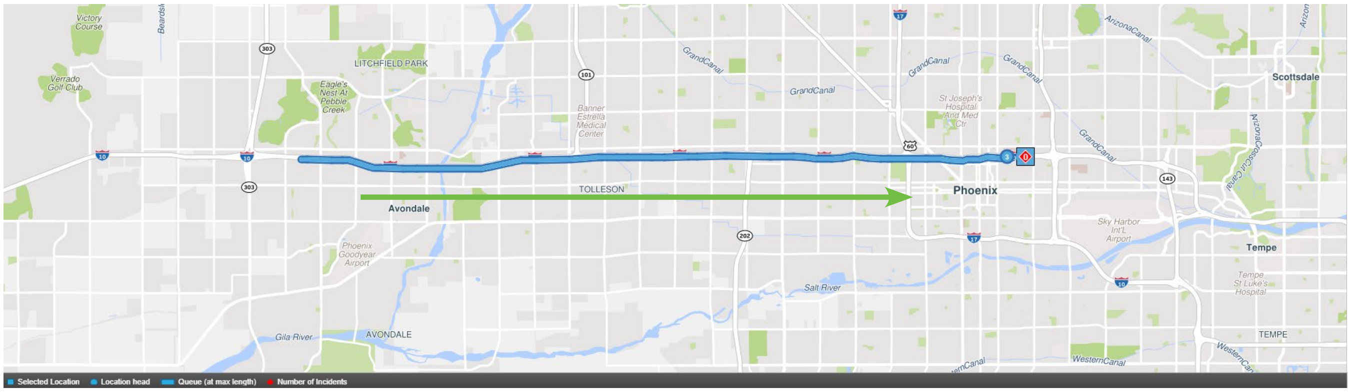
Bottleneck #3 — I-10 Eastbound, from approximately Bullard Avenue to 7th Street (Exit 145)



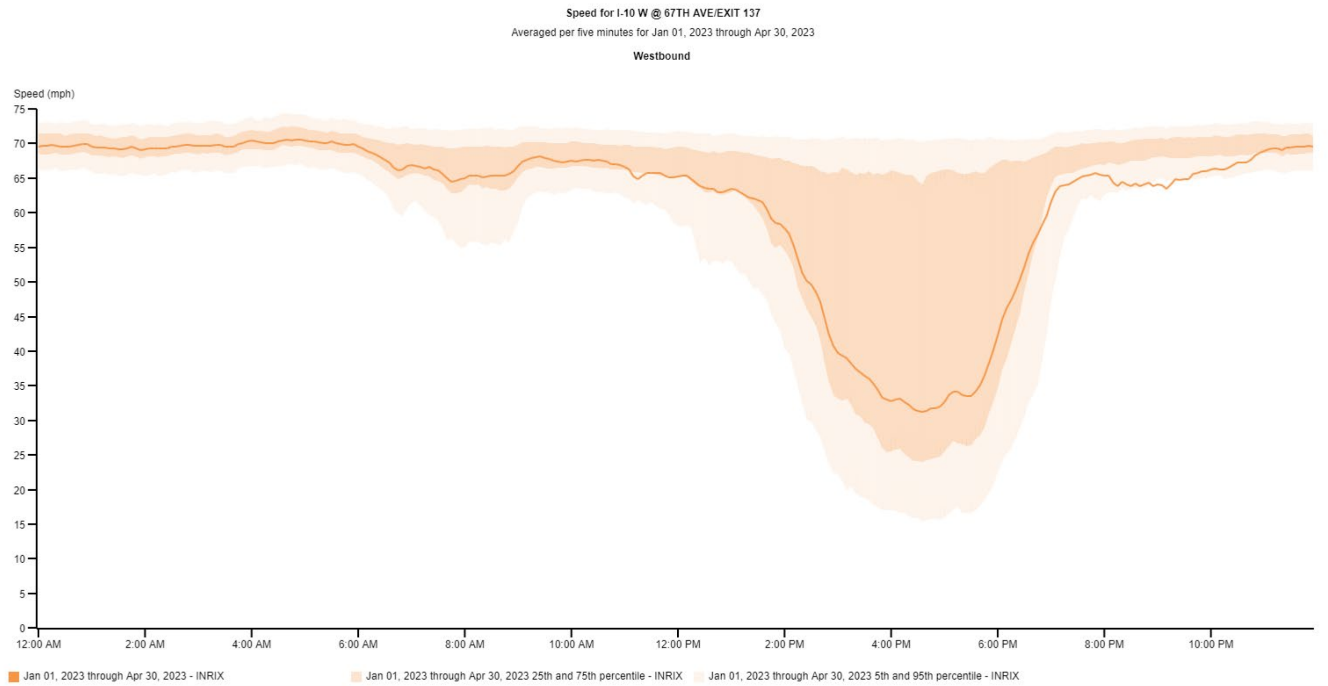


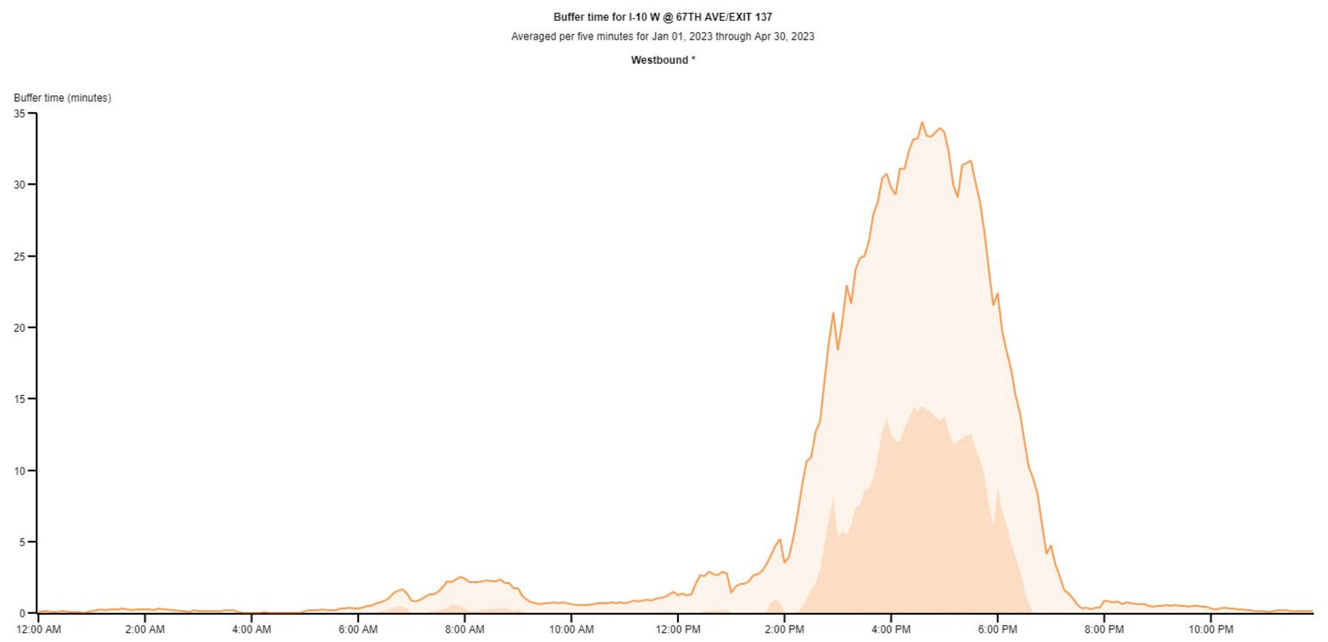
* These missing segments are a result of 0 MPH measurements. Buffer time cannot be calculated when the 95th percentile speed for a road segment is 0 mph or not available.

This bottleneck passes through three freeway interchanges (Loop 101, Loop 202 and I-17) and ranges about 18 miles. Both morning peak period and evening peak period experience bottlenecks, whereas the bottleneck is at the highest during the morning peak period between 6 AM and 9 AM. The average speed during the morning peak hour drops from 65 mph to 35 mph, and the commuters experience up to 40 minutes buffer time in this corridor. Figure below summarizes the location of the bottleneck.



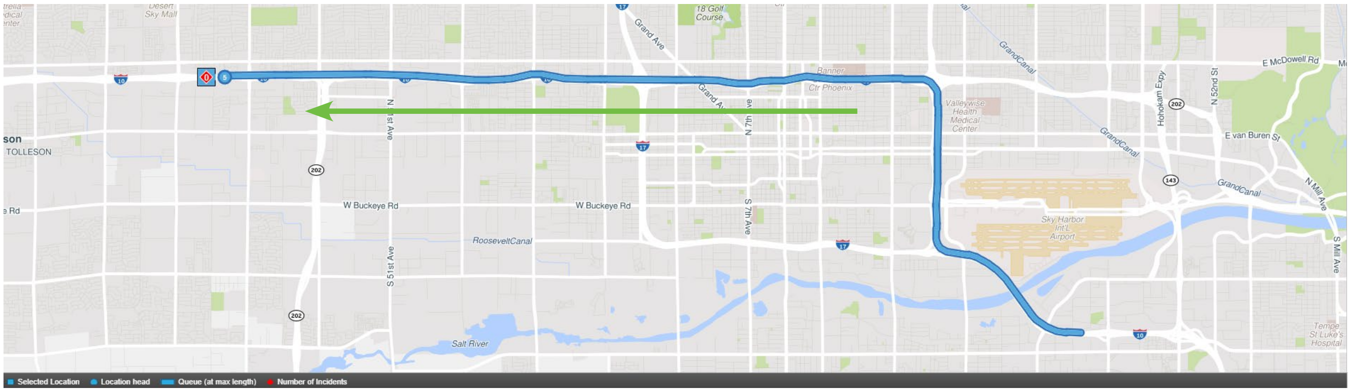
Bottleneck #4 — I-10 Westbound, from approximately 40th Street (Exit 152) to 67th Avenue (Exit 137)



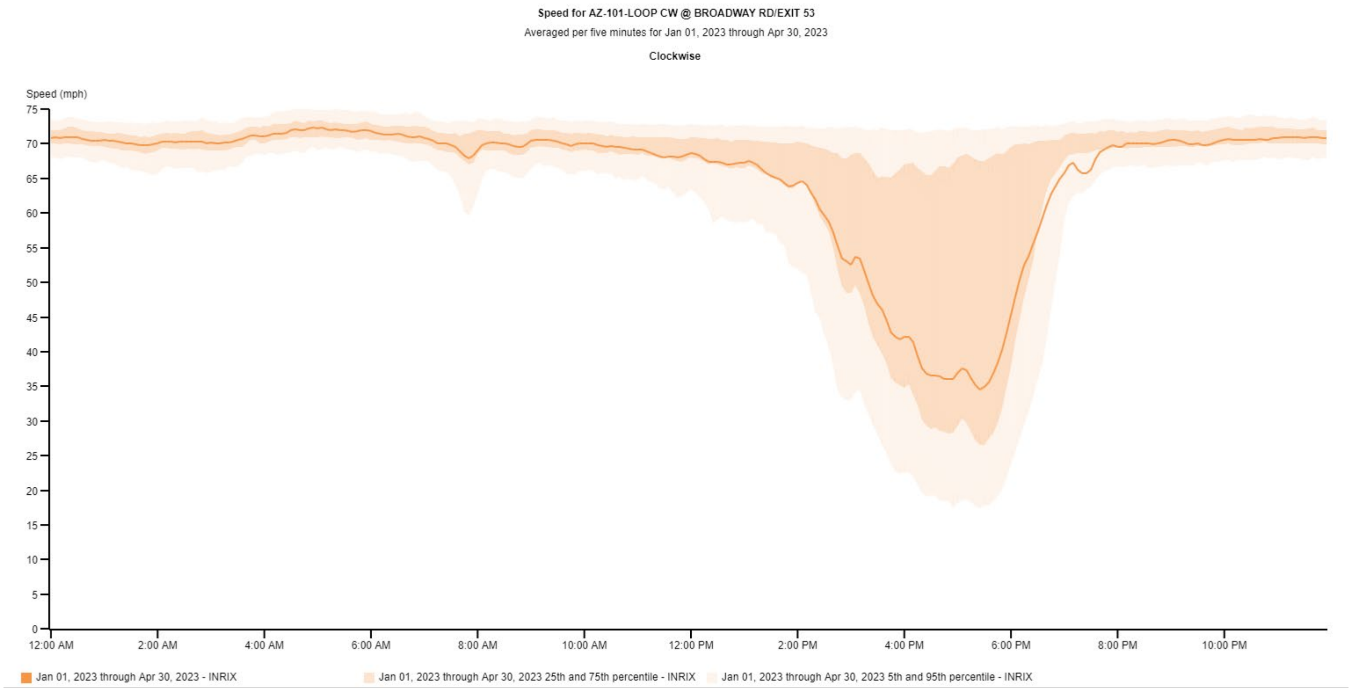


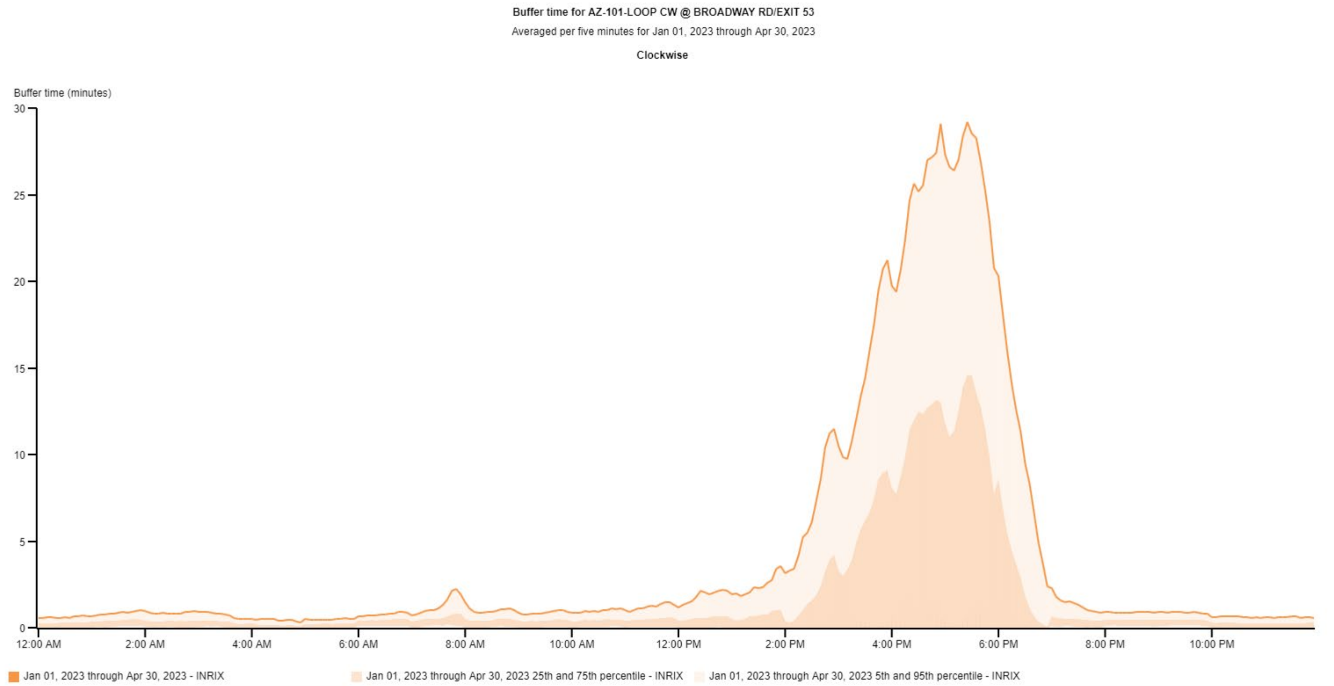
* These missing segments are a result of 0 MPH measurements. Buffer time cannot be calculated when the 95th percentile speed for a road segment is 0 mph or not available.

The length of the bottleneck from the head is 14 miles. The evening peak period experience bottleneck between 2 PM and 6 PM. The average speed during the evening peak hour drops from 65 mph to 35 mph, and the commuters experience up to 35 minutes buffer time in this corridor. Figure below summarizes the location of the bottleneck.

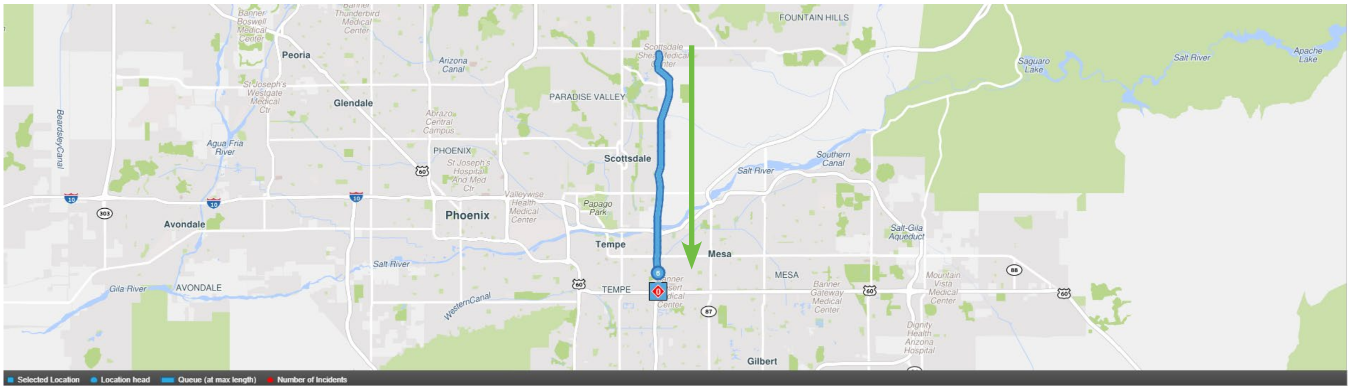


Bottleneck #5 — Loop 101 (Pima Freeway) southbound, from approximately Shea Boulevard (Exit 41) to Broadway Road (Exit 53)





The length of the bottleneck from the head is 15 miles. Congestion is observed during the evening peak period between 2 PM and 6 PM. The average speed during the evening peak hour drops from 65 mph to 35 mph. Commuters experience up to 30 minutes of buffer time in this corridor. Figure below summarizes the location of the bottleneck.



Non-recurring

Congestion caused by construction, crashes, or special events is classified as non-recurring. This type of congestion is more difficult to mitigate due to its sporadic nature. Identifying and quickly responding to non-recurring congestion events is vital in reducing their impact. The 2020 System Performance Report contains **an example of non-recurring congestion at State Farm Stadium**, but hundreds of events occur in the region each year. Each event brings unique challenges and stresses to the network.

ACCESSIBILITY & EQUITY

INTERREGIONAL COMPARISON OF MOBILITY & EQUITY

In the 2022 System Performance Report , MAG performed a regional analysis examining accessibility through a lens of equity for phenomena such as congestion, safety, and transit performance. This iteration seeks to expand that exercise by performing a similar analysis across MAG's peer regions. In the 2021 System Performance Report, MAG designated the following regions as its peers based upon geographic proximity and demographic similarity:

- Denver Regional Council of Governments (DRCOG)
- Houston-Galveston Area Council (H-GAC)
- North Central Texas Council of Governments (NCTCOG)
- Sacramento Area Council of Governments (SACOG)
- Southern California Association of Governments (SCAG)

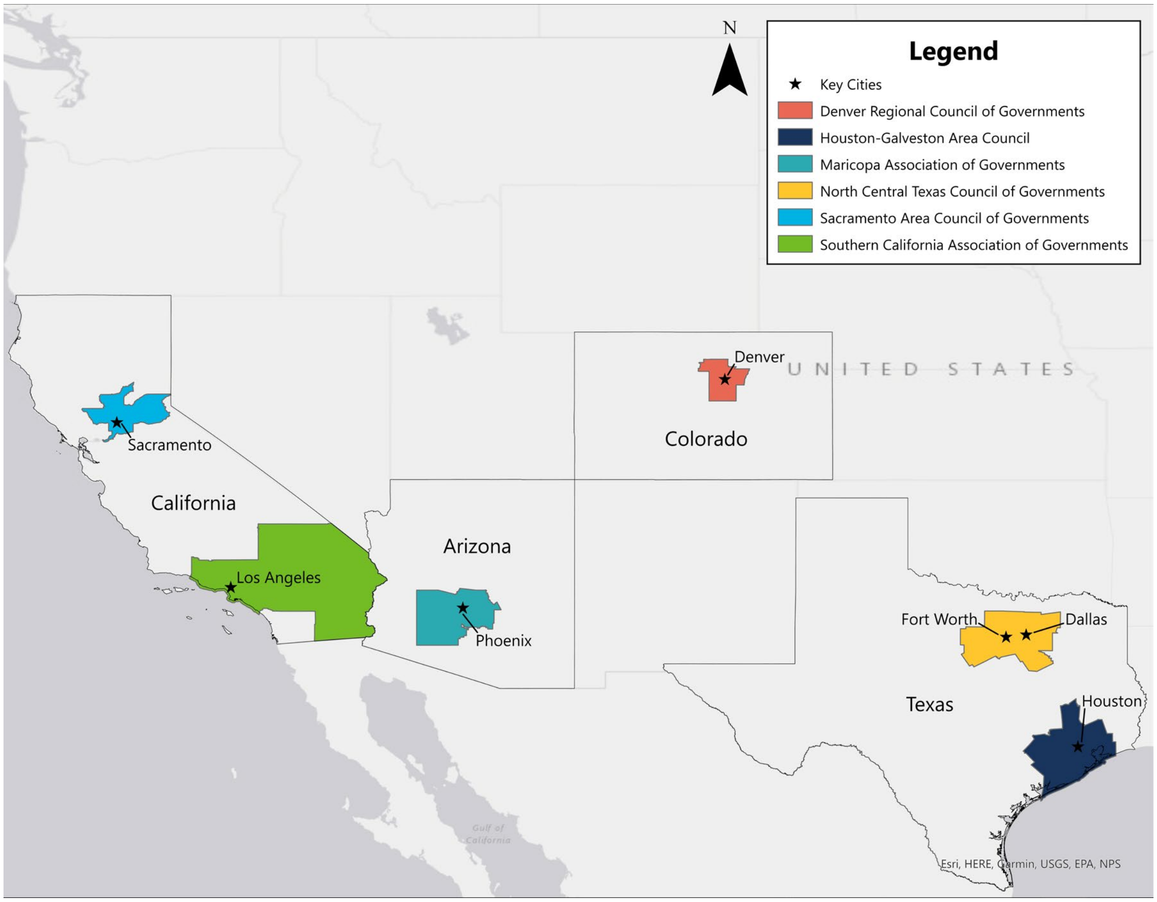


***Figure 2** — Illustration of the locations for each agency of study.*

The following datasets were sought:

- **Auto**
  - Annual Average Daily Traffic (AADT)
  - Crashes by Road Segment
  - Crash Rate by Road Segment
  - Level of Travel Time Reliability (LOTTR)
  - Roadway Speed by Road Segment
- **Transit**
  - General Transit Feed Specification (GTFS)
  - Street Facilities Network
  - Transportation Analysis Zone (TAZ) Boundaries
  - Routes and Stops
- **Equity**
  - Justice40 Disadvantaged Census Tracts
  - Considerations to Title VI

Table 5 below highlights public dataset availability by region:

Region	Auto Data	Transit Data	Equity Data
DRCOG	Yes*	Yes	Yes
H-GAC	Yes*	Yes	Yes
NCTCOG	Yes*	Yes	Yes
SACOG	Yes*	Yes	Yes
SCAG	Yes*	Yes	Yes

Table 5— *Public datasets availability by region.*
**Enough data for a partial, high-level analysis*

Analyses were performed at the smallest possible level of geography – given the lack of robust congestion and safety data, a high-level analysis was performed as applicable. Equity considerations were made using the federally designated disadvantaged communities from the Justice40 initiative and alignment to Title VI, providing a uniform standard across regions. To learn more about this process, please visit **the Justice40 initiative.**

Auto Comparison

The **2022 System Performance Report** performed a localized analysis, examining congestion at the community level – similar data was unfortunately unavailablefor MAG's peer regions. Given this limitation, a high-level overview examining congestion was performed. This section utilizes data from TomTom's traffic index, which looks at metrics like annual **time spent in traffic and average speed in rush hour for metropolitan areas**. It's notable that while close, the following data may not be geographically precise to the bounds of the selected Metropolitan Planning Organizations.

Congestion

Congestion is a phenomenon that impacts the movement of people and goods and exacerbates air quality and climate issues due to increased fuel consumption. People caught in congestion also experience losses of valuable time – individuals endure rush hour traffic instead of spending time with loved ones, on hobbies, or working. Chart 10 shows the annual average time spent in traffic per commuter for the whole of 2022.

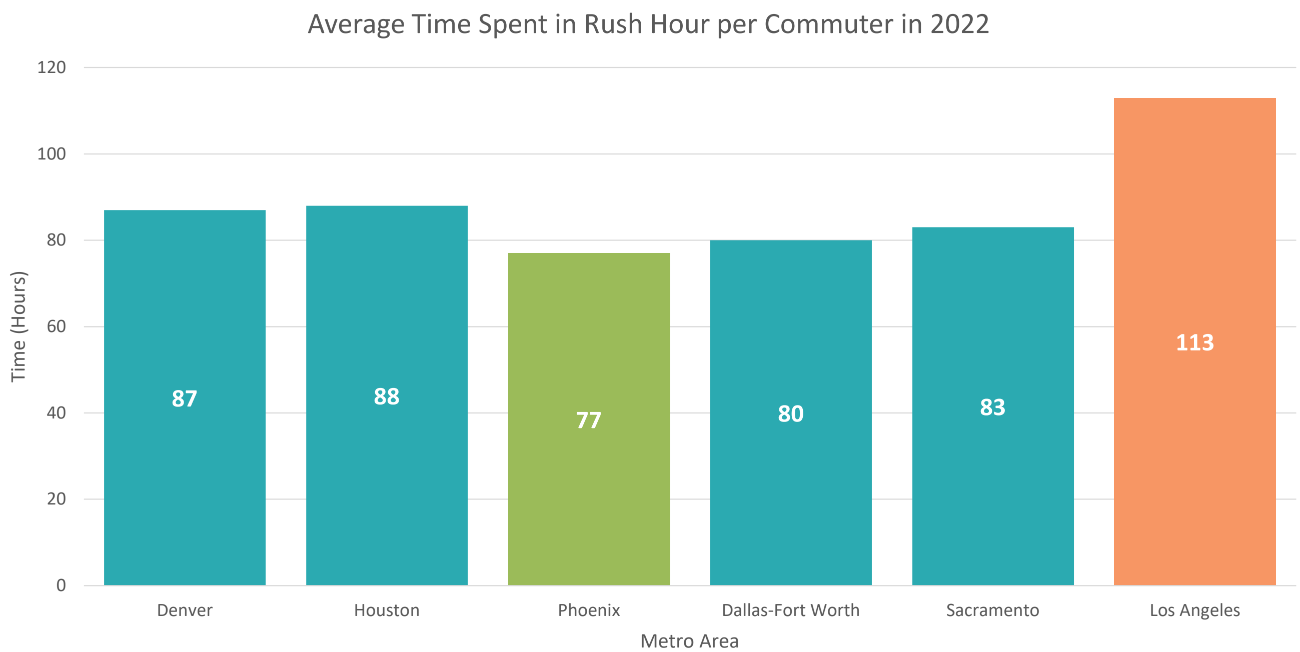


Chart 10*— Annual average time spent in rush hour per commuter in 2022.*

These data show that the Phoenix and Dallas-Fort Worth metropolitan areas experience less congestion than their peer regions It's important to note that each of these regions address congestion differently – some focus on improving transit and active transportation access, whereas others focus on expanding road facilities. Both approaches result in different long-term implications surrounding future congestion.

Transit Comparison

To compare transit performance across regions, uniform datasets were required. Most transit agencies publish General Transit Feed Specification (GTFS) data publicly. GTFS datasets are universally formatted and house information on transit stops, routes, and schedules. Esri's spatial analyst tool then allows for different analysis.

The study began by collecting GTFS data from each transit operator in the respective regions. These included:

Region	Transit Operators
MAG	Valley Metro
DRCOG	Regional Transportation District (RTD)
H-GAC	Houston Metro
NCTCOG	Dallas Area Rapid Transit (DART) Fort Worth Transit Authority (FWTA)
SACOG	Sacramento Regional Transit (SACRT) Yolobus Transit
SCAG	Foothill Transit Los Angeles Department of Transportion (LADOT) Los Angeles County Metropolitan Transportation Authority (LACMTA, branded as METRO) Metrolink Trains Orange County Transportation Authority (OCTA) Riverside Transit Agency Ventura County Transportation Commission

Table 6*— Transit operators in each study region.*

Note that Unitrans and El Dorado Transit in the SACOG region lacked compatible data and were excluded. Following data collection, an analysis was performed examining levels of high-frequency service. Metrics that would have been impacted by the excluded service were removed from the analysis.

Regional Frequent Service

This analysis examines service from 5 AM to 11:30 PM – given the range of time, some routes may have changes in frequency. To account for this, average frequencies of 20 minutes or less were included in the “high frequency” category. A second condition was set that 60 total departures should occur from respective stops within the 18.5-hour period. This ensures that the “high frequency” category only includes services which operate frequently throughout the day. High frequency service is a critical aspect of transit performance. Chart 11 shows high-frequency transit service as a percentage of each region’s total service.

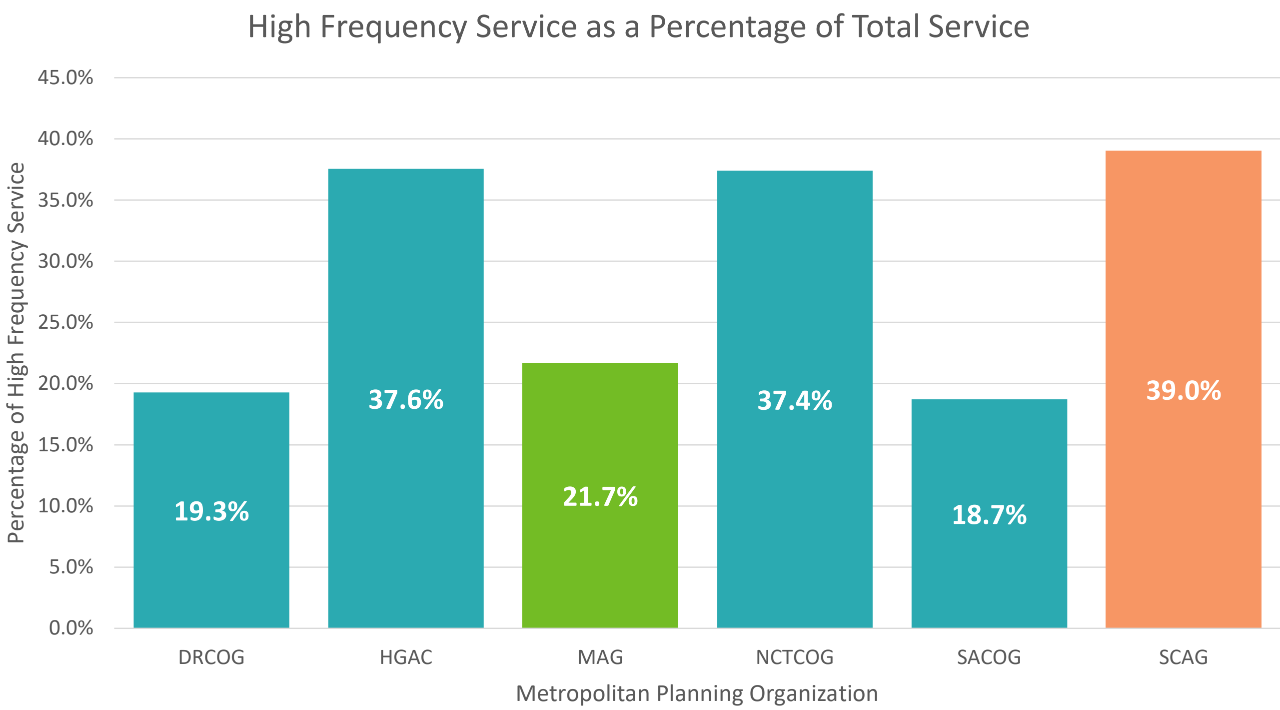


***Chart 11**— High frequency service as a percentage of total service in each of the study regions.*

The data show that the SCAG region provides the strongest proportion of frequent service with the H-GAC and NCTCOG regions close behind. This isn't to say that the other regions are under-performing – many agencies target high frequency transit to specific communities or offer special services that operate intermittently. In other words, many agencies operate transit differently and these differences can impact this metric.

High frequency service typically operates at intervals of 15 minutes or less. Many stops see a transit vehicle within an hour's time – however, a handful of stops in each region bore a uniquely high headway time indicating the presence of specialty routes. Due to these high values, a median frequency was calculated across all stops in each respective region. This metric shows how consistently vehicles depart the standard transit stop. Chart 12 illustrates stop-level median frequency.

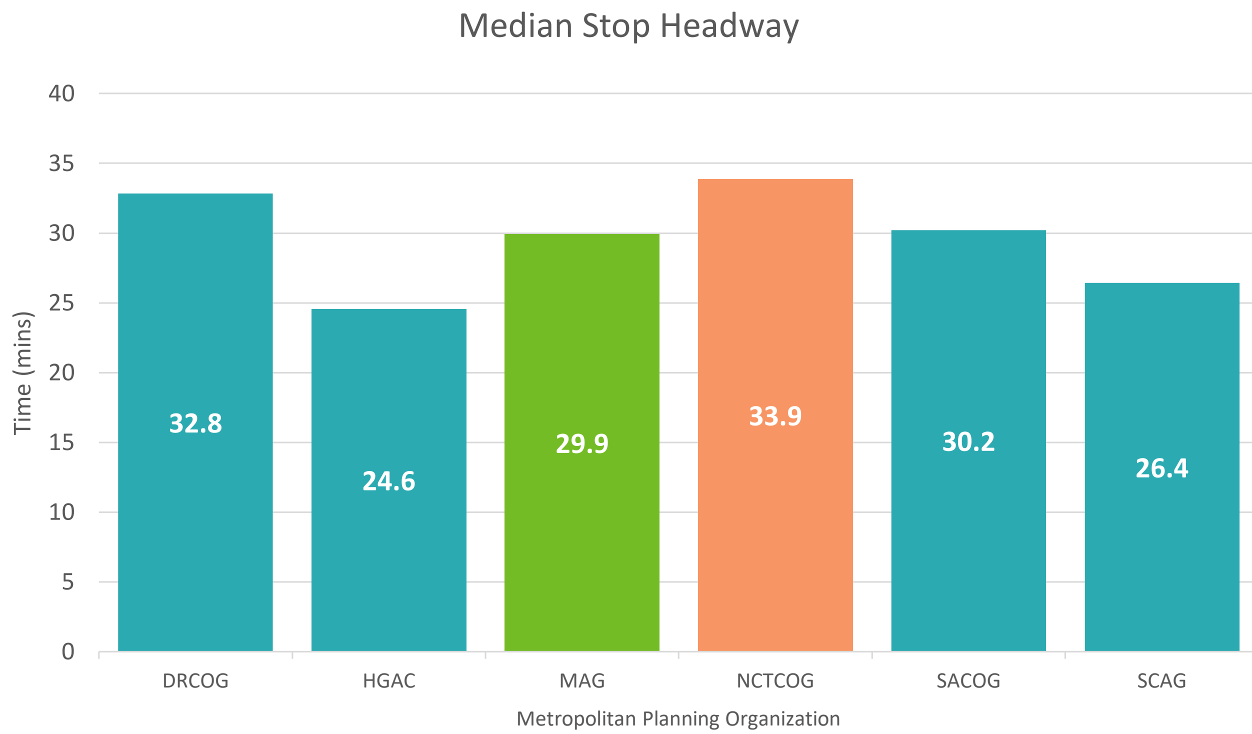


***Chart 12**— Median headway time for transit stops in each of the study regions.*

The HGAC region was observed to have the shortest median frequency, with the standard transit vehicle departure occuring every 24.6 minutes. HGAC's standing in this category is likely due to the 10-minute frequency seen consistently for its rail network, as well as 12- to 15-minute frequency for many of its bus routes. HGAC notably offers limited service with greater than 30-minute frequency – some of the comparison regions offer more services with 45-minute to an hour frequency, as well as specialized services to key locations. For example, RTD in the DRCOG region operates its NB1 and NB2 routes, connecting the Eldora Mountain Resort to Boulder roughly every two hours during the week.

Frequent Service for Disadvantaged Communities

As highlighted previously, high frequency service is critical to transit performance. Transit is an especially important service for people with lower incomes and historically disadvantaged communities. Some regions intentionally target high frequency service to disadvantaged communities. Chart 13 showcases the percentage of Justice40 disadvantaged population within walking distance of high frequency transit. This metric was created by calculating the percentage of disadvantaged area within ¼-mile of high frequency stops for each census tract. For the sake of this exercise, it was assumed that population is distributed equally within each census tract. The calculated percentage was then applied to each tract's respective population value. These values were then summed up and divided across the total Justice40 population. Note that the disadvantaged census tracts that would have been served by the excluded SACOG transit service were removed from consideration.

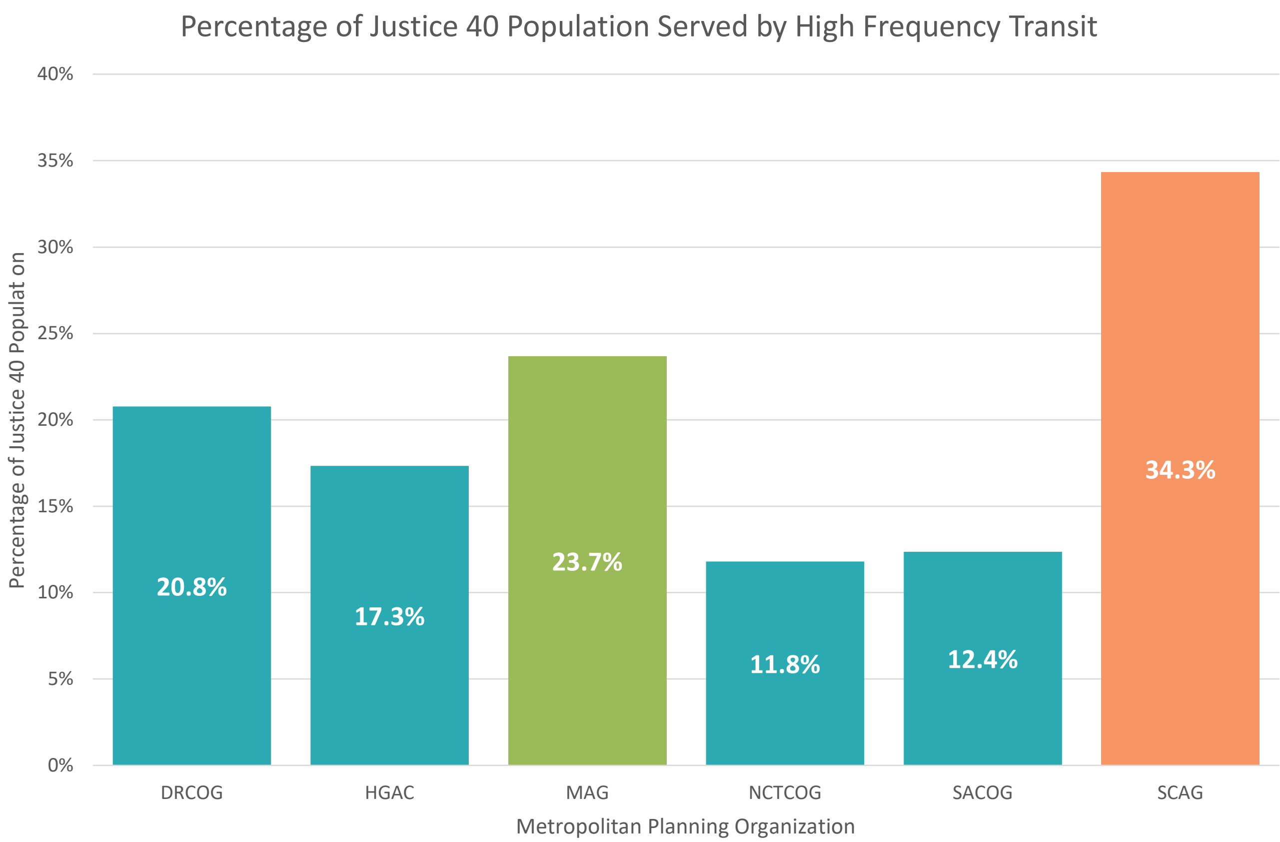


***Chart 13**— Percentage of Justice40 population served by high frequency transit in each of the study regions.*

It becomes apparent that the SCAG region best connects its disadvantaged communities to high frequency service. This is likely due to the population density in the urban core of Los Angeles – transit better serves people when they're located closer together. Figure 3 illustrates the SCAG region's high frequency transit stops and their considerations to Title VI and its relation to Justice40 disadvantaged communities.

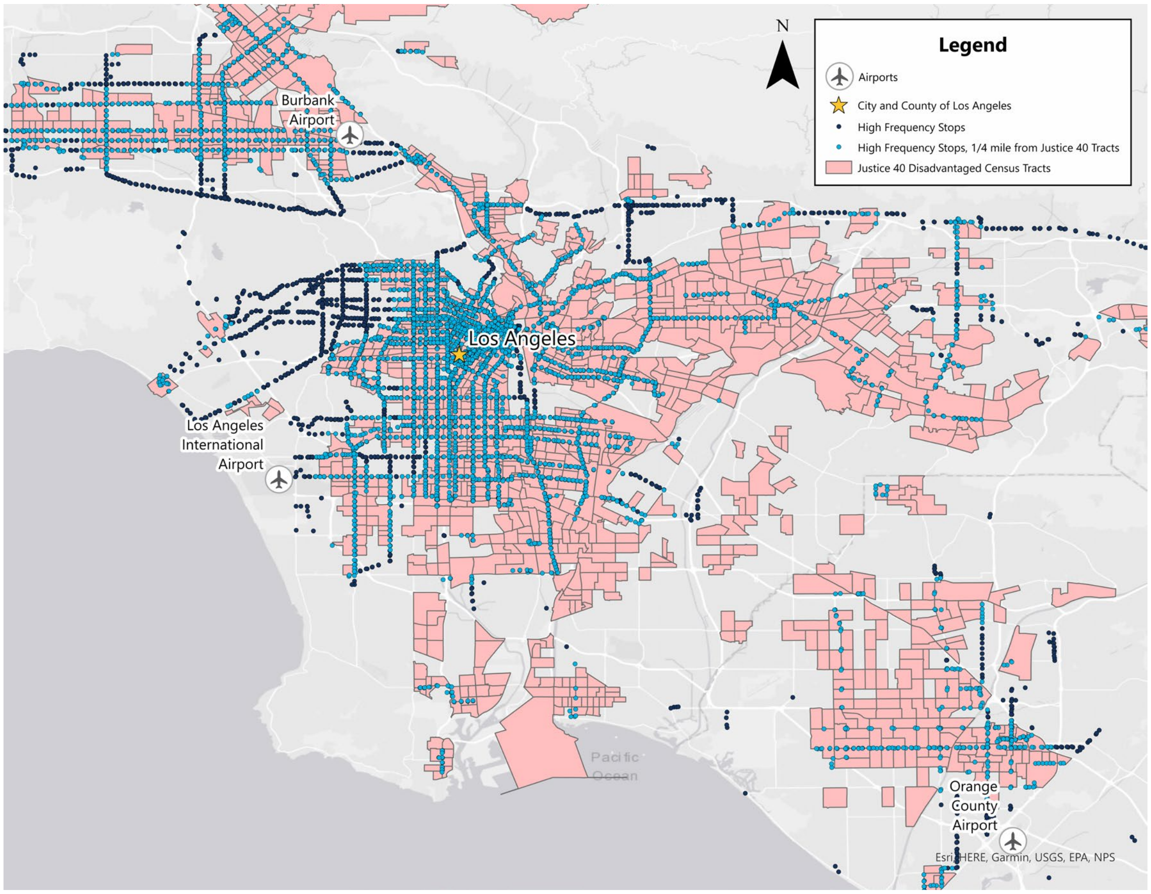


Figure 3*— The SCAG region's high frequency transit stops and their relation to Justice40 disadvantaged communities.*

It's clear that much of the SCAG region's network is centered in disadvantaged areas. The SCAG region's disadvantaged population has greater access to high frequency service compared to the other study regions. Figure 4 highlights a ¼-mile buffer to denote Justice40 walking distance to high frequency stops.

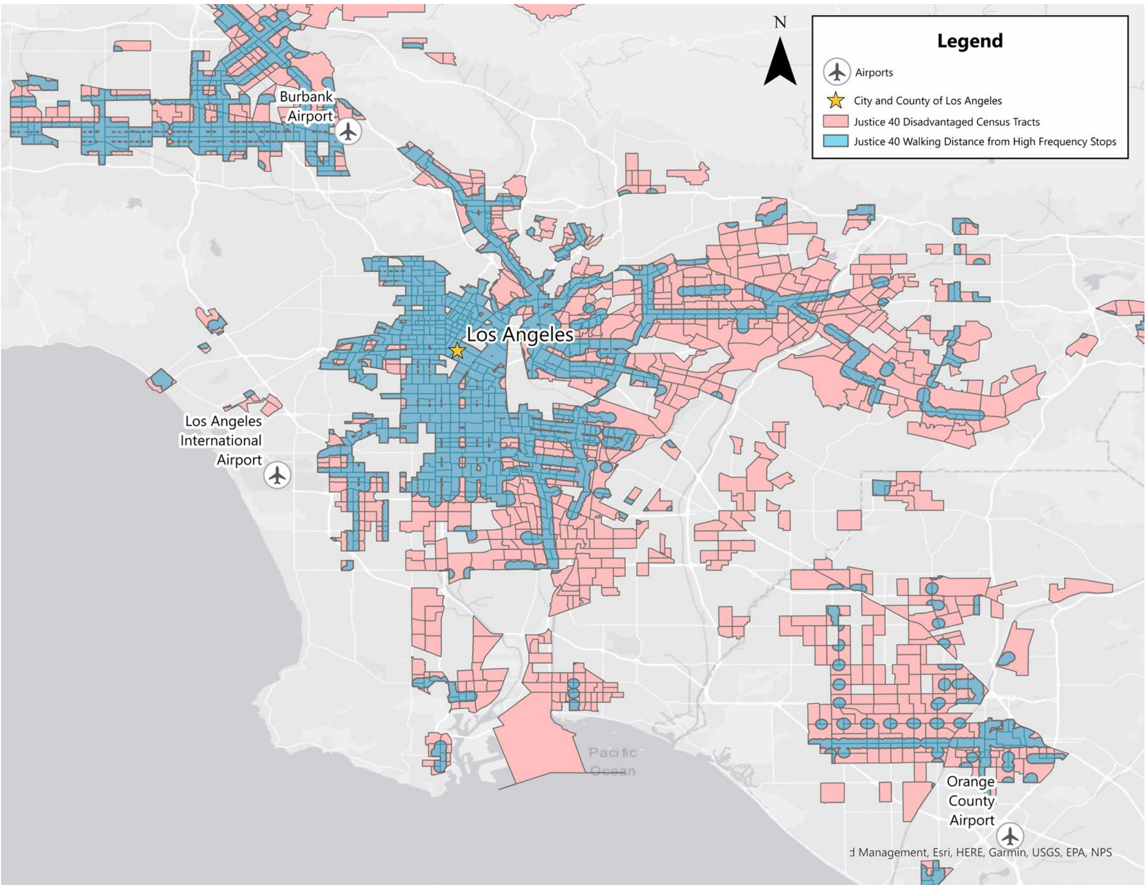


***Figure 4**— A ¼-mile buffer to denote Justice40 walking distance to high frequency stops.*

The extent of coverage from the walking distance buffer confirms that a strong portion of the disadvantaged population benefits from access to the network. Such access enables connections to key destinations, opportunities, and other locations served by the network.

Following the onset of the COVID-19 pandemic, regions large and small have grappled with impacts to transit ridership and changes in the dynamics driving congestion. The data in this analysis show that regions approach congestion and transit service differently. Some address congestion by building new or widening existing facilities, whereas others focus on expanding the use of other modes. Some target key transit services to specific destinations and communities compared to others' focusing on the network. Each region will have its own unique challenges based upon funding, environmental, and political considerations. These factors will continue to color their decision-making processes in addressing these issues.

Each of the study regions bear unique tradeoffs that the other regions can learn from. MAG endeavors to improve all modes of travel to best serve its residents in the region. The Transportation Performance Program will strive to continue conducting analyses that get to the root of issues, informing the planning process as impactfully as possible.

TEMPE STREETCAR

INTRODUCTION

In May 2022, the Tempe Streetcar represents the latest addition to the region's frequent, high-capacity transit network . Though its operational data is still in the early stages of collection, it offers initial insights into the Tempe Streetcar's performance and impact.

This chapter provides a data-driven overview of the streetcar's performance metrics since its inception. The areas of focus will include the justification for streetcar construction, ridership performance, and comparisons to other streetcar systems in the United States. While other areas of focus, such as traffic impacts, are of interest to MAG, this chapter primarily centers on the streetcar's operational metrics and its role within the broader transit landscape.

The data presented offers a preliminary understanding of the Tempe Streetcar's contributions to the region's transit ecosystem and sets the stage for more comprehensive analyses in the future.

What is the Tempe Streetcar?

Briefly mentioned in 2022 MAG System Performance Report, the Tempe Streetcar is the Valley's first modern streetcar line adding to Tempe's comprehensive transit network and serving one of **the highest ridership centers in the region**. The three-mile system consists of fourteen stops, with two connections to the existing Valley Metro Rail. What separates the streetcar from traditional light rail is that the streetcar operates primarily in mixed traffic. Vehicles are also smaller than traditional light rail vehicles, with capacity for around 125 people, are predominantly in the middle of the street right-of-way, and **stops are smaller and occur more frequently than light rail stations**.

While construction began in 2017, planning for the Tempe Streetcar had been ongoing for over a decade. The primary objective of the streetcar was to enhance connectivity within the city and link major hubs of activity such as Tempe Town Lake, Mill Avenue, and ASU's Tempe campus, and to alleviate congestion on the Mill Avenue Corridor. By championing alternative transportation, Tempe expected to add an estimated **2,000 additional daily riders** within the city from the streetcar. Along with adding to Tempe's transit ecosystem, the city sought to continue the momentum of billions of dollars in economic growth brought on by the adjacent light rail system and have the streetcar act as **a further catalyst for development** in Tempe's already dense, vibrant urban core.

CHOOSING THE COURSE: THE LOGIC BEHIND THE STREETCAR'S ROUTE

Figure 5— *A route map for the Tempe Streetcar illustrating stop locations, connections to light rail, intersections with streets, and points of interest. Source: Valley Metro*

There were foundational goals that the city wanted to achieve with the implementation of the region's first modern streetcar. To understand the vision for how the current alignment was chosen to best serve residents, students, visitors, and businesses it is important to identify where people live, work, and spend their free time.

Population and Employment density

By 2040, MAG projects a population growth of approximately 48% in Tempe since 2015. Concurrently, Tempe's general plan anticipates an increase of 55,000 residents and 18,000 housing units, with an even more dramatic increase of 75,000 employees which is corroborated by **MAG's own predictions** at the time. This unprecedented growth in population and employment has generated an increased number of daily trips, and with over 40% of Tempe's forecasted growth expected to occur within one-half mile of the streetcar alignment, the existing transportation network is operating near design capacity. Previous expansions of the transportation network have meant that there is little to no space to add additional capacity through adding travel lanes without causing irreparable harm to the built environment and an alternative method was required, thus the implementation of Tempe Streetcar. Below are figures from planning documents that illustrate this **projected population and employment growth** in relation to the streetcar alignment by 2030.

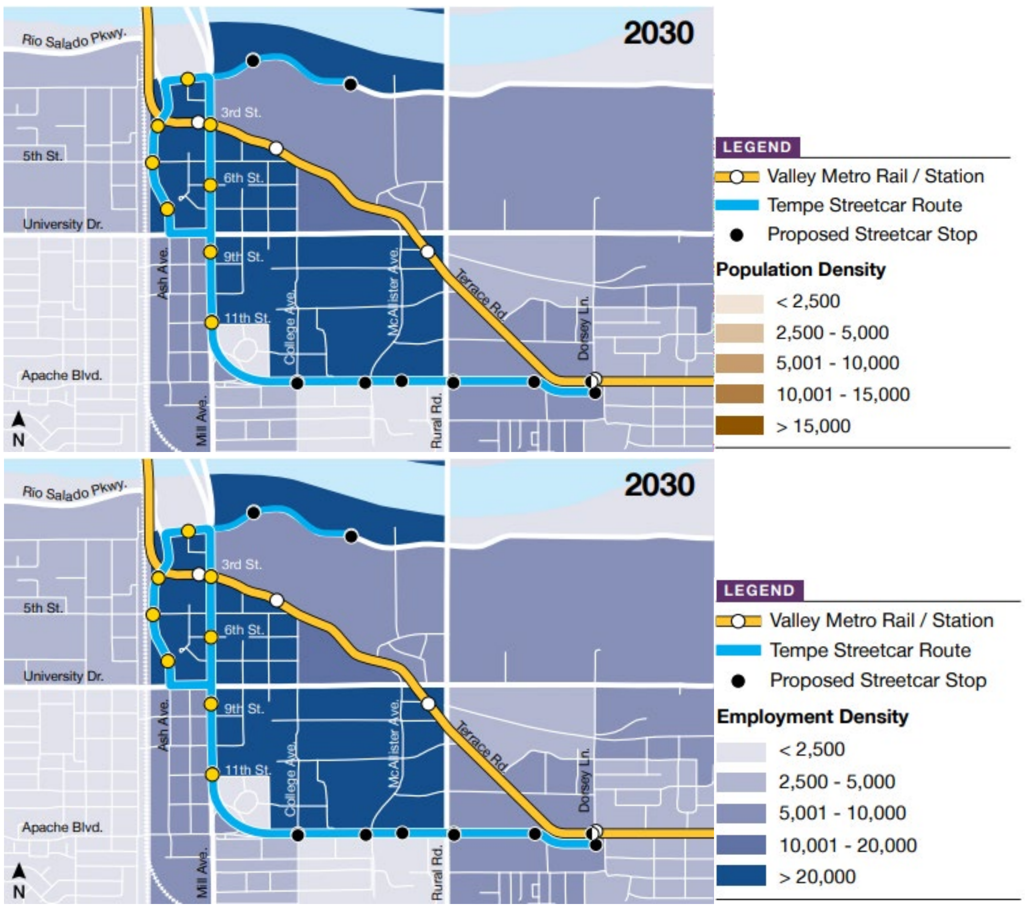


***Figure 5**— Population and employment density along Tempe Streetcar alignment. Source: Valley Metro*

Land Use and Development

In addition to the streetcar alignment being located along areas of large population and employment growth, Tempe's 2040 General Plan also supports an increase of density and development along the route. As shown in the figure on the next page, the areas zoned around the streetcar alignment allow for mixed-use development to occur within ½-mile of all stations. The downtown area allows for unlimited density and building height, while the rest of the corridor is in the **Transit Oriented Development (TOD) zone**, allowing higher-intensity developments that incorporate transit-supportive designs such as reducing parking and being set closer to the sidewalk.

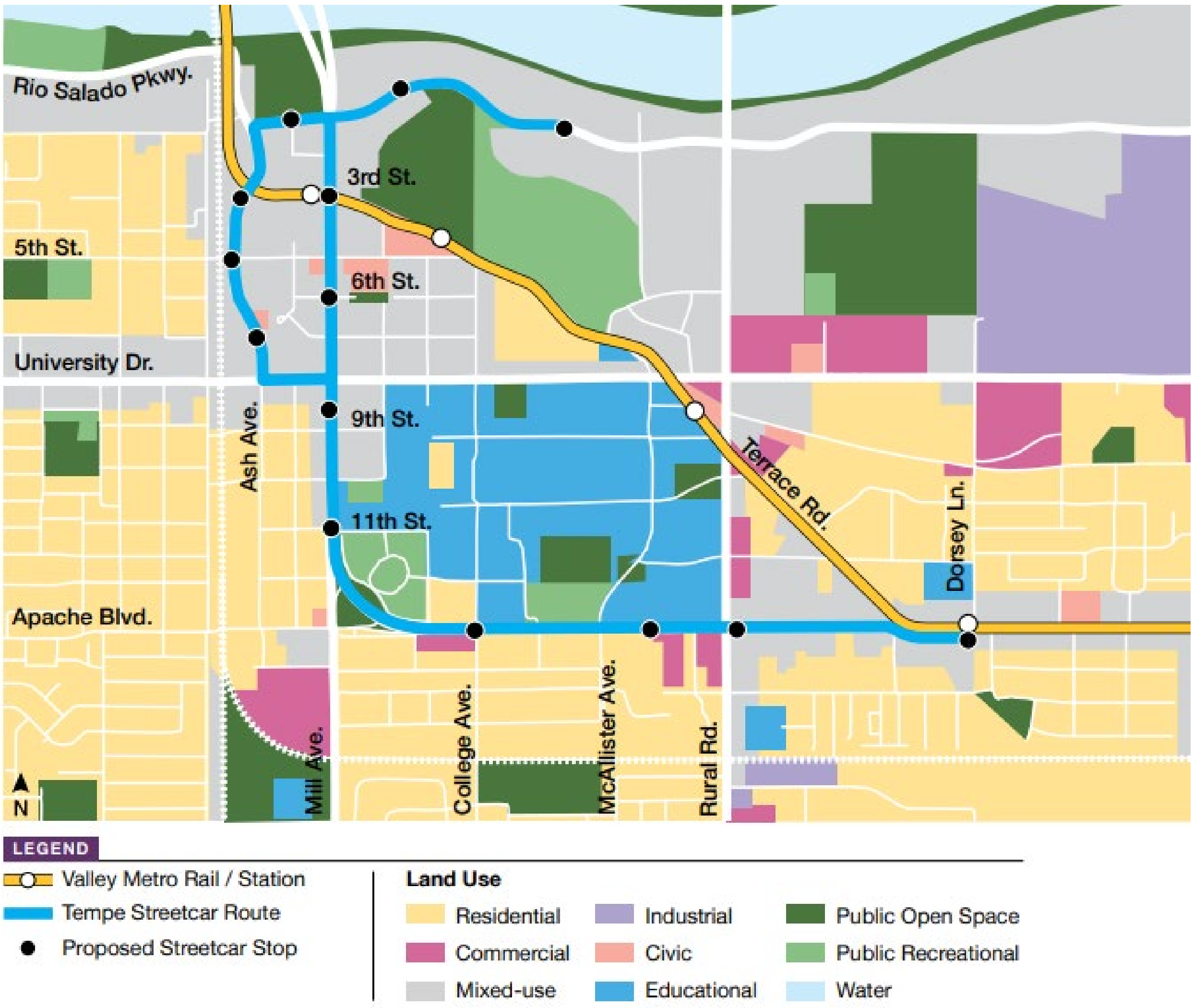


Figure 6— Land use surrounding Tempe Streetcar alignment. Source: Valley Metro

The General Plan, along with the implementation of the streetcar, assists in the city's goal of promoting a multi-modal network that strengthens mobility, safety, accessibility to jobs, housing, and services. The streetcar serves as a backbone of "interhub" connectivity that eliminates the need for widening roads.

NAVIGATING THE NUMBERS: INITIAL PERFORMANCE METRICS

This section aims to provide a comprehensive, data-driven assessment of the Tempe Streetcar's initial operational Performance. Given the streetcar's revenue operations only began in May of 2022, the data presented here offers a preliminary but insightful look into the system's performance.

Tempe Streetcar Ridership

Valley Metro's FY2023 ridership reports show that Tempe Streetcar is the 14th highest ridership transit line and the **second highest ridership transit line serving Tempe** behind only Valley Metro Rail. Tempe Streetcar, with its 14 stops along a three-mile route, served **622,208** riders. Along with the annual ridership report, Valley Metro publishes detailed rail ridership reports for each month which can assist in identifying segments of the system that are busiest and putting them into context.

To underscore the role that the streetcar has played in Tempe's transit network, all routes serving Tempe (bus and rail) combined total over 6.25 million boardings. The streetcar with over 620,000 boardings contributed to approximately **9.95% of total boardings** in the city. Despite being a relatively new addition to Tempe's transit landscape, this figure serves as a baseline metric for evaluation of the streetcar's future performance and impact.

To further investigate the segments and stations of the line that have the highest ridership and boardings, the map on the right will assist in visualizing what is being discussed. Each circle represents a station, with station names listed as well as bus and rail lines where there are connections.

While boardings along the whole route are largely consistent, data available shows that there are some stops with disproportionately high numbers of boardings and alightings (passengers exiting a vehicle) compared to the other stops along the route. Notably, the streetcar's connection with Valley Metro Rail at Dorsey Drive/Apache Boulevard sees a significant increase in both boardings and alightings as well as the Rural Road/Apache Boulevard stop. This is also the case for several other stops such as the Marina Heights/Rio Salado Parkway stop and the 9th Street/Mill Avenue stop.

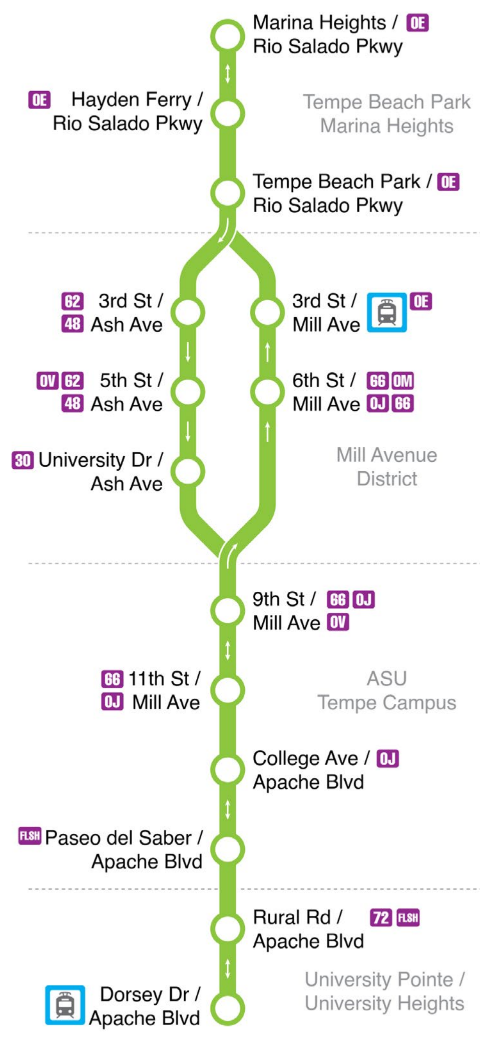


***Figure 7**— Streetcar route with connections and districts labeled.*

To the right is the same route map from before, but with the stations that have total monthly boardings and alightings over 3,000 passengers except for 3rd Street/Mill Avenue. and 6th Street/Mill Avenue These two stations are highlighted because they have significantly higher alightings compared to their boardings.

For the month of July, the 6th Street/Mill Avenue stop had 1,023 total boardings, less than the average of 2,773 boardings. However, it had 3,650 total alightings which is **29% more** than the average of 2,808. 3rd Street/Mill Avenue, where the streetcar connects with Valley Metro Rail, also sees **83% more** total alightings than total boardings. What this indicates is that riders from stops serving University Heights and the ASU campus are riding downtown, but those already there are not boarding the streetcar to travel towards Marina heights. What we do see is that 9th Street/Mill Avenue, the closest stop on Mill Ave. that has trains Southbound, sees **45% more** total boardings than average.

Staying with July's ridership data as it is the most recently available, Dorsey Drive/Apache Boulevard and Rural Road/ Apache Boulevard are the most used stops along the route with total boardings between the two stops averaging **6,734** and total alightings averaging **6,521** riders. The connection to Valley Metro Rail at Dorsey Drive, the park and ride availability, and the density surrounding these stations makes the high stop utilization expected.

While the ridership data for the month of July was used as it is the most recently available and detailed, it wasn't the month with the highest ridership. For the last fiscal year, the months of November, March, and April each had ridership between **70,000 and 80,000**, combined accounting for over 1/3rd of the total yearly ridership for the streetcar.

Finally, the last metric to evaluate the streetcar's ridership performance is streetcar ridership as a share of Valley Metro's fixed route ridership. Valley Metro only has one other fixed route, Valley Metro Rail, which had 9,498,986 boardings across its entire route, and 1,939,644 total boardings in Tempe alone. As a share of the entire fixed route system, the Tempe streetcar ridership constitutes approximately **6.15%**, while as a share of the fixed-route system in Tempe alone is **24.29%**. These figures demonstrate that as a part of the entire fixed-route system, the streetcar serves as a small but not insignificant percentage of ridership, while in Tempe its contribution to fixed route ridership is more substantial.

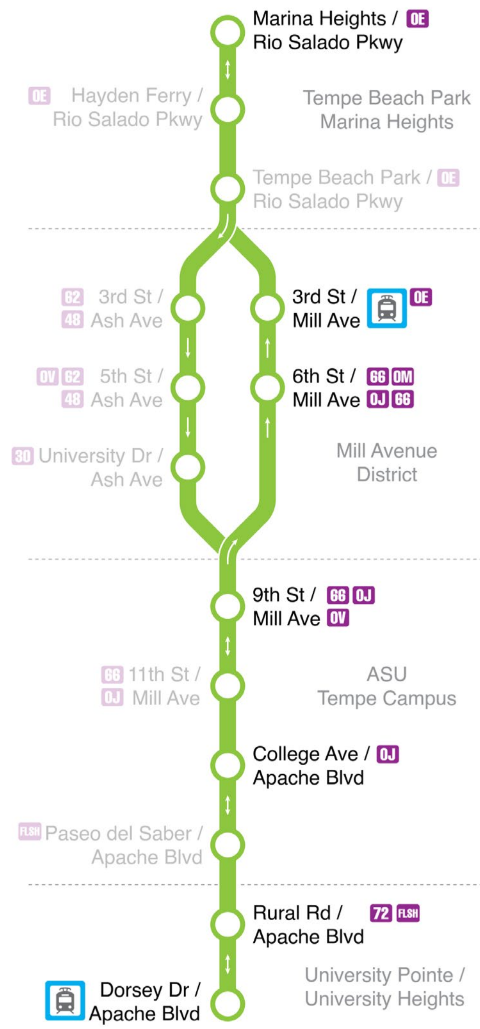


***Figure 8**— Streetcar route with connections and districts labeled.*

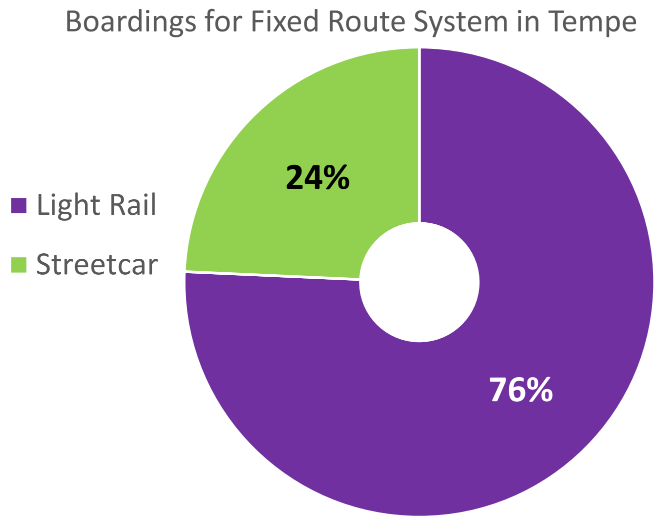


Chart 14— Percent Share of Fixed Route Boardings in Tempe and the Entire Network

Local Development

The construction of rail transit in the region has had a substantial impact on the development of the local economy and connected communities with frequent, reliable transit service. Along the corridor for Valley Metro Rail, more than $17.1 billion in capital investment, **both public and private**, and $2.1 billion additional private commercial and residential buildings have been constructed. In 2018, **Valley Metro Rail has aided in growing** employment along its corridor by more 35,000 jobs and encouraged the development of 50 million square feet of new construction. Since its construction and revenue service, Tempe has seen two large developments around the streetcar line whose construction can be directly linked to investments in rail transit, specifically the Tempe Streetcar:

100 Mill

Located on a 2.5-acre site along Rio Salado Pkwy directly across Tempe Beach Park, **100 Mill** is a 15-story Office building that also includes 2,900 square feet of retail space. **This mixed-use development** was created as part of a private joint-venture between three private real estate firms, as well as the rehabilitation of the historic Charles Trumbull Hayden House to its original condition.

The developers of 100 Mill attribute the selection of the site to its proximity to not only Valley Metro Rail, but also Tempe Streetcar which the Tempe Beach Park/Rio Salado Pkwy stop is adjacent to.[10] They also state that Tempe's commitment to its expansion of public transportation and unique walkable character as a reason that they, along with other national corporations seek to have a location in Tempe.[10]

Tempe Depot

Built on the site of the nearly 100-year-old Tempe train depot, **this mixed-use development** features a 17-story office tower with approximately 320,000 square feet of office space, and an 18-story hotel with approximately 280 rooms and 9,400 square feet of conference space. The development also has several thousand square feet of ground floor retail and restaurant space and an equally large public plaza.[12]

Due to its unique location, Tempe Depot has incorporated both Valley Metro Rail and Tempe Streetcar into its design, as well as the integration of the historic train depot and its adjacent rail right-of-way. The site has a streetcar stop onsite (3rd St./Ash Ave.), and Valley Metro Rail tracks bisect the site where it stops at the adjacent light rail station. The developers emphasize the site access to public transportation including Tempe Streetcar multiple times in their **promotional material** and highlight its importance to the project.

The developments of each of these sites show a continued, strong, and positive response to the region's investment in rail transit and the influence Tempe Streetcar has at spurring transit-oriented local development. Both 100 Mill and Tempe Depot attribute access to Tempe Streetcar and Valley Metro Rail as an integral part of their projects, fulfilling the goals set prior to construction of the route.

Other Streetcar Systems

While the Tempe Streetcar is a recent addition to the city's transportation network, several other U.S. cities have established similar second-generation streetcar systems. Cities like Portland, Washington D.C., Kansas City, and Tucson have operated their systems for several years longer than Tempe. Each of these systems has its own set of characteristics influenced by local factors, but their longer operational history provides valuable data points.

Streetcar systems are highly contextual and are shaped by several variables from urban density and layout, to gaps in local transportation needs. As such, each city's streetcar systems possess unique attributes that make direct comparisons challenging. To draw meaningful insights, it's essential to identify a comparable system that closely aligns with Tempe's specific characteristics. This allows for a more nuanced understanding of Tempe Streetcar's performance and benchmarking it with other streetcar systems.

Sun Link Streetcar

The Sun Link Streetcar, also known simply as the Tucson Streetcar, is a modern streetcar system in Tucson, Arizona. It began operations in 2014 and serves a 3.9-mile route with 23 stops connecting districts within Tucson including the University of Arizona, Downtown Tucson, and the Mercado District. While Tempe and Tucson are different cities, aspects of their streetcar systems lend themselves to relatively direct comparisons:

1. **University Connection:** Both systems serve areas near major universities (University of Arizona for Tucson Streetcar, and Arizona State University for Tempe Streetcar), making them crucial for student transportation.
2. **Tourist and Local Appeal:** Both streetcars serve areas that are of interest to both locals and tourists, such as downtowns, shopping districts, and cultural landmarks.
3. **Scale:** Both are relatively small-scale rail systems, making them more directly comparable in terms of operational challenges and benefits.
4. **Proximity and Climate:** Being in Arizona and so relatively close to each other, both systems are subject to similar regulations and funding opportunities, and operating in similar climates means that variables related to such can be better accounted for.

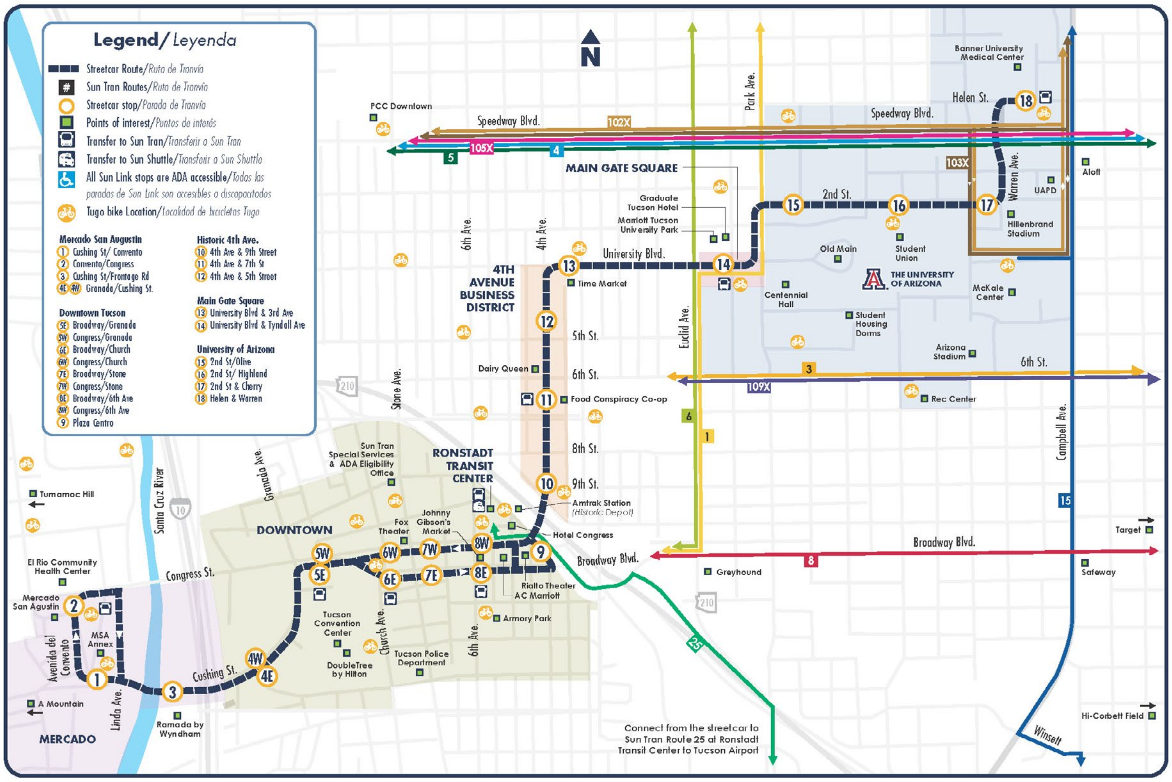


Figure 10— Route map of Sun Link Streetcar in Tucson, Arizona. Source: Sun Tran

The most straightforward way to compare the two systems and to benchmark the Tempe Streetcar is to understand Sun Link ridership performance. **Sun Link ridership information** is publicly available from 2019-2022, with monthly reporting going back to 2021. Note, FY2019 includes the annual ridership for FY2018, however it is not a detailed breakdown of that year's ridership

Analyzing ridership performance, there is a noticeable drop in FY2021-2022 due to the pandemic. So, a comparison will be made between 2019 and 2022 reports. Sun Tran **eliminated fares** in 2020 during the Covid-19 pandemic, so the first year that has rebounded ridership is also being affected by the fare elimination. With this, there is a significant increase in ridership that was seen, more so than the ridership growth rate **seen previously**.

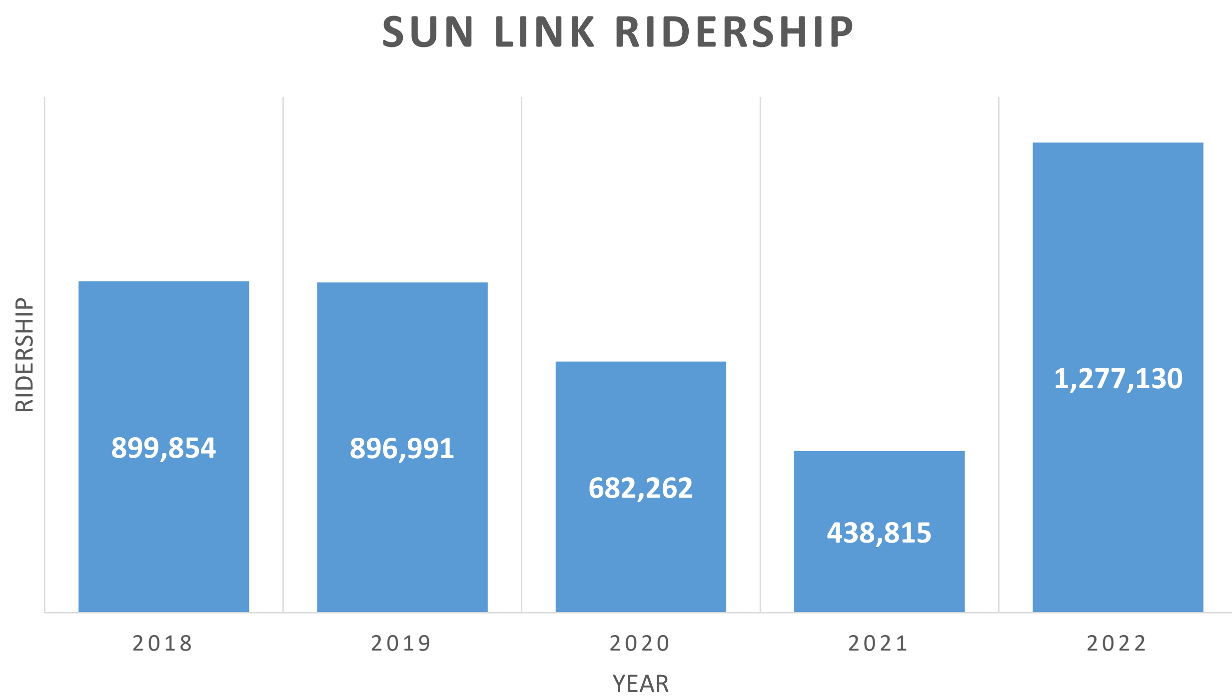


Chart 15— *Sun Link ridership between 2018-2022*

Ridership was generally stable before 2020, and the Covid-19 pandemic severely impacted ridership during 2020 and 2021, **a trend seen across the country**. Rebounding ridership and the elimination of fares saw a 136% increase from 2019 ridership in 2022. Passengers per service mile, a metric used to measure utilization and service effectiveness, saw an increase of approximately 1.66 passengers per service mile from approximately 4.43 to approximately 6.09. For comparison, the Tempe Streetcar served an average of **approximately 4.05 passengers per service mile** for FY2023.

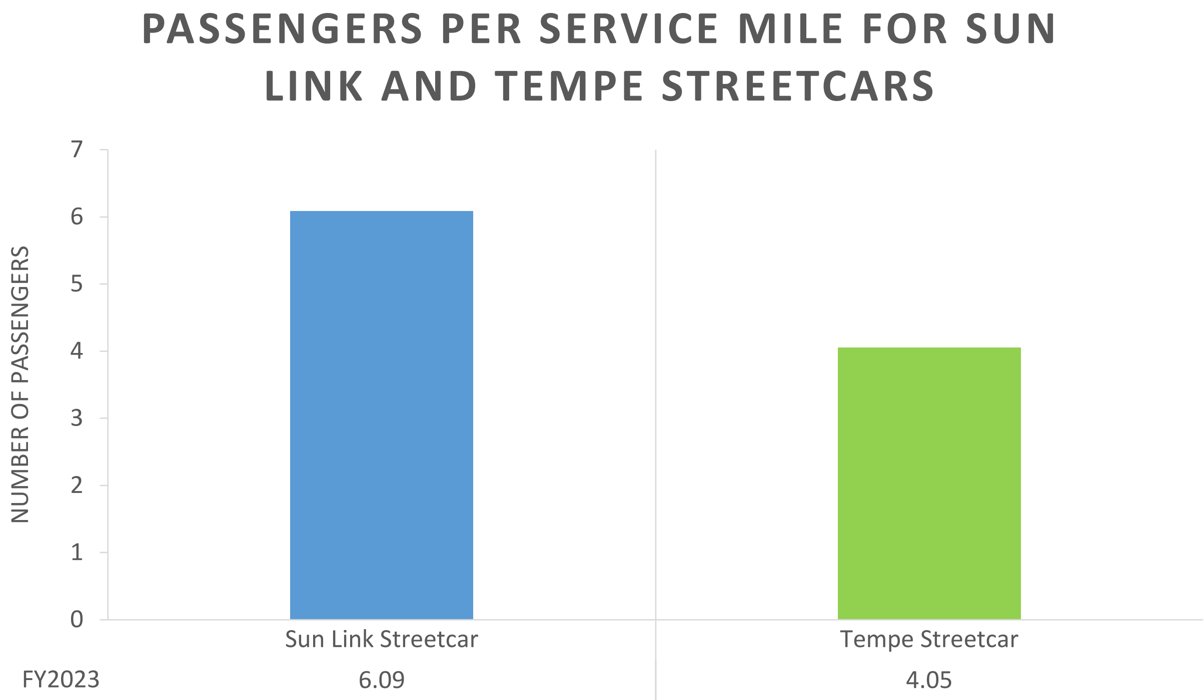
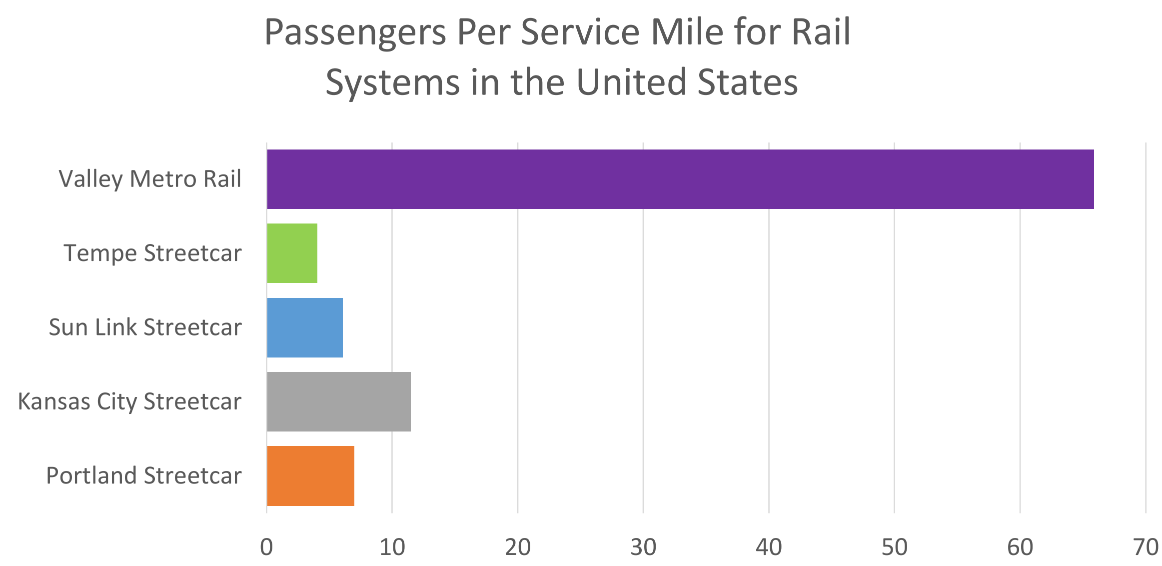


Chart 16*— Passengers Per Service Mile for Sun Link and Tempe Streetcar FY2023*

As an additional comparison, these calculations can be done for other systems for additional perspective:

- **Portland Streetcar**, consisting of an AB loop with 55 stops and NS Line with 17 stops, carried an average of **~7.00 passengers per service mile** for FY2023.
- **Kansas City Streetcar**, consisting of a 10-stop line, carried **~11.51 passengers per service mile** for FY2022.
- **Valley Metro Rail**, a 28-mile line with 32 stations serving three cities, carried **~65.90 passengers per service mile** for FY2022.



	Portland Streetcar	Kansas City Streetcar	Sun Link Streetcar	Tempe Streetcar	Valley Metro Rail
Passengers Per Service Mile	7	11.51	6.09	4.05	65.9

***Chart 17**— Passengers Per Service Mile for US streetcar systems and Valley Metro Rail.*

While the Tempe Streetcar is still in its infancy, with only one year of revenue service in its operational history, there is something from the comparison to Sun Link that could help with its future success. Particularly with fares, the Tempe Streetcar is operating fare-free during its initial opening with a $1 suggested fare to be implemented in the future. From what was seen with Sun Link fare elimination and the increase in ridership that coincided, an inverse effect is to be expected with fare implementation.

The Tempe Streetcar has already made a significant impact on the city's transit landscape since its inauguration in May 2022. Thoughtful route planning designed to connect key residential, commercial, educational, and cultural hubs has not only boosted ridership in the region, but also spurred local development. Initial performance metrics indicate a promising start with the streetcar accounting for nearly 10% of total boardings in Tempe. Moreover, its influence on transit-oriented developments, like 100 Mill and Tempe Depot, underscores its role as a catalyst for sustainable urban growth.

As we look to the future, it becomes increasingly important to continue monitoring key performance indicators and to adapt strategies for improvement. The comparative analysis with Tucson's Sun Link Streetcar provides valuable insights into the challenges and opportunities that lie ahead. Focus should be on optimizing service reliability, expanding connectivity, and enhancing the rider experience to solidify the streetcar as an indispensable asset in Tempe's multi-modal transit ecosystem. Such focus and improvement contribute to a more connected, sustainable, and vibrant region.

PROJECT-LEVEL PRIORITIZATION & ANALYSIS

Project-Level Prioritization and Analysis

Evaluating, prioritizing, and analyzing projects is essential and foundational work at a MPO. MAG uses a variety of tools, data, and techniques to analyze of lenses. Starting in 2008, MAG develop a spreadsheet-based analysis tool as part of its Congestion Management Process. The tool served as the foundation for model call for projects and was modified as needed to suit the analysis required.

For more information, visit **Congestion Management Process**

Recently, MAG has completed work on an interactive online platform to automate the analysis and processing of much of the data required for a performance-based prioritization effort. The Arterial and Bridge Needs Research created platform also allows users to search, filter and query the underlying datasets and provides regional context to the scores provided.

For more information, visit **Arterial and Bridge Needs Research Platform**

MAG continues to research and develop criteria and methodology to ensure best practices in project-level prioritization and evaluation are being utilized across the agency.

Future of the System Performance Report

As MAG looks towards a holistic approach to project development selection and programming, the report will continue to provide a vital connection in the process.

In addition to maintaining and setting federal performance targets, the program is also responsible for the evaluation of projects. This important work faces several challenges. Coordination with other programs to ensure the availability of project-specific data will remain a focus of the program, as will the creation of a central repository for transportation-specific data to improve our ability to manage and access datasets that span the agency. Continuing to carefully curate the balance between quantitative and qualitative inputs in project selection remains among the highest priorities and greatest challenges for the program.

Emerging datasets and the advancement of data collection techniques will continue to advance the state of the practice. The Transportation Performance Program strives to evaluate and integrate new technologies whenever possible.

Appendix A – State & Federal Guidance

View complete texts and more information about relevant federal and state statutes by browsing the links below:

Proposition 400

Title 28 – Transportation
AZ Rev Stat § 42-6105 – County Transportation Excise Tax
AZ Rev Stat § 28-6303 – Regional Area Road Fund; Separate Accounts
AZ Rev Stat § 48-5103 – Public Transportation Fund
AZ Rev Stat § 28-6354 – Annual Report; Hearing; Priority Criteria

Federal Performance Measures

23 CFR 450.306: Scope of the metropolitan planning process
23 CFR 450.322: Congestion management process in transportation management areas
23 CFR 450. 324: Development and content of the metropolitan transportation plan
23 USC 119: National highway performance program
23 USC 134: Metropolitan transportation planning
23 USC 135: Statewide and nonmetropolitan transportation planning
23 USC 148: Highway safety improvement program
23 USC 149: Congestion mitigation and air quality improvement program
23 USC 150: National goals and performance management measures
23 USC 167: National highway freight program
23 USC 402: Highway safety programs
49 USC 5301: Policies and purposes
49 USC 5303: Metropolitan transportation planning
49 USC 5304: Statewide and nonmetropolitan transportation planning
49 USC 5310: Formula grants for the enhanced mobility of seniors and individuals with disabilities
49 USC 5326: Transit asset management
49 USC 5329: Public transportation safety program
49 USC 5335: National transit database
49 USC 70202: State freight plans

Appendix B – Transportation Performance Data & Sources

The Transportation Performance Program relies on a wide variety of datasets produced at different governmental levels. The list below includes a brief description of the datasets, and. An attachment to this document provides clarity for each dataset that informs the measures produced by the program.

- **FHWA - Highway Performance Monitoring System (HPMS)** - The HPMS is a national-level highway information system that includes data on the extent, condition, performance, use, and operating characteristics of the nation's highways. The HPMS contains administrative and extent of system information on all public roads, while information on other characteristics is represented in HPMS as a mix of universe and sample data for arterial and collector functional systems. Limited information on travel and paved miles is included in summary form for the lowest functional systems. HPMS was developed in 1978 as a continuing database, replacing the special biennial condition studies that had been conducted since 1965. The HPMS has been modified several times since its inception. Changes have been made to reflect changes in the highway systems, legislation, and national priorities, to reflect new technology, and to consolidate or streamline reporting requirements.
- **ADOT - Freeway Management System (FMS)** – ADOT is one of the leading public agencies in the nation in the realm of Intelligent Transportation Systems and FMS. ADOT is taking advantage of the following intelligent infrastructure monitoring devices for management and operation of freeways:
    - FMS devices in Phoenix region and Tucson area covering 490 directional miles of freeway
    - Over 415 data collection stations, collecting traffic data (i.e., flow, occupancy, speed) using various technologies
    - Over 360 ramp meters
    - A total of 208 dynamic message signs statewide to disseminate traffic, weather and advisory information to drivers on the road
    - A total of 284 closed-circuit televisions to monitor and verify incidents, as well as coordinate with the Department of Public Safety
    - Road Weather Information Systems at 17 sites
    - Wrong-Way Detection at 12 sites
    - Travel time displays in the Metro Phoenix and Metro Tucson areas on 82 dynamic message signs
- **FHWA - National Performance Management Research Data Set** - FHWA has acquired a second (v2) national data set of average travel times on the NHS for use in its performance measures and management activities. This data set is also available to State Departments of Transportation and Metropolitan Planning Organizations to use for their performance management activities. The dataset will be available monthly.

- **University of Maryland's CATT Lab via FHWA Contract – Regional Integrated Transportation Information System (RITIS)** – RITIS is a situational awareness, data archiving, and analytics platform used by transportation officials, first responders, planners, and researchers, among others and more. RITIS fuses data from many agencies, many systems, and even the private sector—enabling effective decision-making for incident response and planning. Within RITIS are a broad portfolio of analytical tools and features. Ultimately, RITIS enables a wide range of capabilities and insights, reduces the cost of planning activities and conducting research, and breaks down the barriers within and between agencies for information sharing, collaboration, and coordination.
- **ADOT – Accident Location Identification Surveillance System (ALISS)** – ALISS is a crash data archive for ADOT. The primary source of data for this database is the State Highway Log system. The data is not "real time".
- **HERE Data** – HERE captures location content such as road networks, buildings, parks and traffic patterns. It then sells or licenses that mapping content, along with navigation services and location solutions to other businesses such as Alpine, Garmin, BMW, Oracle, and Amazon.com. In addition, HERE provides platform services to smartphones. It provides location services through its own HERE applications, and also for GIS and government clients and other providers, such as Bing, Facebook, and Yahoo! Maps.
- **MAG Travel Demand Model Data** – The MAG travel demand model simulates traffic flows, congestion, and the movement of people and goods. The model relies on population and employment data, surveyed travel data, traffic counts, and various data purchases.
- **Valley Metro GTFS Data** – Valley Metro GTFS data provides the tools to model variables of transit. The GTFS data set contains route information, stop information, and scheduling/frequency data. A model was created to derive traversable distance and frequency information.
- **2020 United States Census Data** – United States Census Data provides population and demographic information. Tract-level data allows spatial examination providing connection to other data sets.

Appendix C – History of Performance Measures at MAG

The process of creating the Performance Management Program at MAG began in 2008 with the development of the Performance Measurement Framework and Congestion Management Update Study. The program was formally initiated in 2009 with the participation of MAG Member Agency modal committee representatives, as well as RTP partners including ADOT and Valley Metro/Regional Public Transit Authority. The intention of the program has been to provide a functional component that links planning and programming activities, using performance data and analysis. This process would introduce enhanced transparency and accountability, improving the quality of transportation investment decisions.

Beginning in 2010, the MAG Performance Management Program began analyzing and reporting on observed speed and volume data reported by ADOT's FMS. These data are collected by a series of detectors including passive acoustic detectors and loop detectors which are embedded in the roadway. These reported data allow MAG to calculate and report on throughput, speed, lost productivity, and extent and duration of congestion. Due to the data collection methods, FMS data is provided for all individual lanes, including high occupancy vehicle facilities.

Starting in 2011, MAG began obtaining speed data from a private sector provider NAVTEQ (later re-named HERE). These speed-only data sets were/are obtained by Bluetooth detectors that connect to Bluetooth enabled vehicles and devices. Due to the inclusive nature of this detection process, these data provide full coverage of data for both the freeway and major arterial networks. Measures calculated from these data sets include speed, delay, congestion, Planning Time Index, and Travel Time Index. Unlike ADOT FMS data, the collection methods for these data do not allow for reporting on individual traffic lanes.

Beginning in 2012 with the Moving Ahead for Progress in the 21st Century Act (MAP-21) and continuing in 2015 with the Fixing America's Surface Transportation Act (FAST Act), the federal government has established rules for measuring performance and setting future targets on a system-level for states and MPOs.

Born from the Congestion Management Update Study, the Congestion Management Process (CMP) tool was designed to complement existing processes. The CMP tool was built to consider RTP goals and objectives, and to score and rank projects accordingly. The base tool used both quantitative and qualitative criteria in its prioritization process and has since been customized to the specific eligibility and funding requirements of various modal programs. To date, specific tools have been created to help program ALCP project changes, as well as project selections for the Pinal County Arterial and Bridge Program, Active Transportation Program, and Systems Management and Operations Program.